EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-001

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base X Option Period Number	001 Machine Shop

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 1., 2., 6.

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2):

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Richard Valentine	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-4437 FAX Number:
Project Officer Name Robin Baily	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:
Other Agency Official Name	(Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Mark Cranley	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

PERFORMANCE WORK STATEMENT

EVALUATION OF COMPOSITE-BASED SURFACE SAMPLING METHODS

HS 7.52.02 – 541

TABLE OF CONTENTS

I	TITLE	1
II	PERIOD OF PERFORMANCE	1
III	SUMMARY OF OBJECTIVES	1
IV	RELEVANCE	1
V	BACKGROUND	1
VI	SCOPE	1
VII	TECHNICAL APPROACH	1
VIII	FACILITIES AND MATERIALS	2
IX	TASKS	2
X	MILESTONES, DELIVERABLES, AND COMPLETION DATES	4
XI	RESPONSABILITIES	4

I. TITLE

Evaluation of Composite-Based Surface Sampling Methods

II. PERIOD OF PERFORMANCE

The period of performance for this Work Assignment (WA) is from April 1, 2016 to March 31, 2017.

III. SUMMARY OF OBJECTIVES

The proposed work will evaluate the relative recovery efficiencies of currently recommended surface sampling devices and methods, when utilized in a discrete manner and when utilized for composite sample collection. The ultimate object is to generate data that can be used to select appropriate sampling devices following a bioterror event. Scientifically-testing sampling methods will provide increased confidence in the ability to characterize contamination following such an event.

IV. RELEVANCE

The products will be used to guide decisions with regard to the selection and application of candidate sampling technologies and methods for characterization of contamination post bioterror incident. The results of this work will be made available through published reports, journal papers, and/or conference abstracts and presentations.

V. BACKGROUND

Methods for detection and characterization of biological agent on surfaces following a bioterror incident include swabs, wipes, and vacuum. These methods are currently deployed on a discrete basis, whereby one sample is collected from one (~ 1ft^2) sample area. Composite-based sample collection, the use of one sampling media to collect samples from >1 sample area, can reduce material and labor costs, and improve response/recovery timelines. Currently, the recovery efficiency of currently recommended surface sampling methods (sponge wipes and 37mm vacuum cassettes) are unknown when applied to multiple sample locations of surface materials common to indoor or outdoor environments.

VI. SCOPE

Under this PWS, the contractor, under the direction of the Environmental Protection Agency (EPA), shall perform a study to evaluate discrete and composite sampling, when using the sponge wipe and 37mm cassette-type vacuum-based sampling device, for collection of biological agent from environmental surfaces.

VII. TECHNICAL APPROACH

A known quantity of *Bacillus* spores will be deposited by aerial dispersion onto large coupons (1 ft.^{2} or greater) containing carpet. The coupons will then be subjected to discrete or composite-based sampling. Recovery will be determined for each sampling method according to culture-based microbiological assays developed by EPA and CDC. All test parameters, such as test chamber size, coupon materials and sizes, sampling methods, methods of extraction / analysis will be determined by agreement among the

EPA project team. The collective set of tests must be able to be completed within the allotted budget.

Table 1. Potential test parameters to vary during experiments

Parameter	Potential Variants
1. Material Surface Types	Carpet (vacuum only), Tile and Drywall (Sponge only), Concrete (both devices)
2. Coupons and Replicates	The number of replicates shall be determined by the amount of effort and funding available.
3. Sampled Area	Three sample area sizes
4. Spore Concentration on Surfaces	Two surface concentrations. (i.e., E6 – E7 ft^{-2}, and E2 – E3 ft^{-2})

VIII. FACILITIES AND MATERIALS

All tasks described in this PWS shall be performed in-house, at the EPA's Research Triangle Park (RTP) facilities at 109 T.W. Alexander Dr., unless approved otherwise by the EPA WAM. The sampling activities shall be conducted in the NHSRC's Decontamination Technologies Research Lab (DTRL) located in H-224, H-222, H-122a, and H-130a. The lab contains the necessary equipment for the tasks described herein. The analysis of the biological samples shall be conducted in the Microbiology lab, located in E-386, E-388, and E-390.

IX. TASKS

To achieve the desired objective of this effort, work for this PWS can be broken down into three tasks. These tasks are a continuation of the testing outlined in the QAPP developed during option 4 (Work Assignment 4-10)

Task 1. QAPP Development

The contractor shall prepare a QAPP in accordance with Quality Assurance (QA) Category_B_. Attachment 1 to the PWS provides information regarding NHSRC QA Requirements/Definitions List.

QAPPs being developed for Category A (formerly Category 1 or 2) projects must be developed in accordance with the document titled "EPA Requirements for Quality Assurance Project Plans." EPA QA/R-5 can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf. At the discretion of the COR, a Category B (formerly category 3) QAPP can be developed based on the R5 guidance or a project-specific QA requirements provided on the NHSRC@work website.

The QAPP must be approved prior to the start of any literature searches (existing data), data collection, gathering, synthesizing, or data generation (laboratory) work. Additional information related to QA requirements can be found at www.epa.gov/quality.

Task 2. Fabrication of Test Material Coupons
Materials shall fashioned into 14" x 14" coupons for testing. Details shall be provided at the time of the work request.

Task 3. Test Experimentation
Sampling devices (sponge stick and 37mm cassette) shall be evaluated for collection of biological agent (non-pathogenic *Bacillus* spores, as surrogate for *Bacillus anthracis*) from material surfaces. Agent will be deposited onto coupon surfaces by the aerosol deposition method developed by NHSRC. Two or Three material types shall be tested for each sampling device. For these tests, experimentation shall be carried out in accordance with the QAPP. Deviations from the QAPP shall be documented in writing and justified.

Task 5. Report Preparation.
Following completion of all data collection, a comprehensive report shall be prepared documenting the details of the tests, including methods, quality control measures utilized, collected data, interpreted results, and conclusions. The report shall follow standard EPA NHSRC report style, and therefore shall conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

Table 2. Example Test Matrix

Device	Sampled Area (#areas x ft^2 each)	Material Types	Spore Surface Concentration	Replicates
Sponge Wipe	1 x 1	Drywall	E6 – E7 ft^{-2}, and E2 – E3 ft^{-2}	5 experimental (per test condition) 3 negative (per material per test day) 3 stainless steel inoculation controls (per test day)
		Tile		
		Concrete		
	4 x 1	Drywall		
		Tile		
		Concrete		
	8 x 1	Drywall		
		Tile		
		Concrete		
37mm Vacuum Cassette	1 x 1	Carpet		
		Concrete		
	4 x 1	Carpet		
		Concrete		
	8 x 1	Carpet		
		Concrete		

X. MILESTONES, DELIVERABLES, AND COMPLETION DATES

QAPP Amendment
A draft QAPP and Work Plan shall be provided within 30 days of the award of this agreement. This shall be provided prior to commencement of the tests described within this PWS. The combined QAPP and Work Plan shall include scope, scheduling, and costing information for each of the tests planned.

Reporting
A Draft Report shall be provided to EPA for review by March 1, 2017. A final report shall be provided 10 business days after EPA comments.

XI. RESPONSIBILITIES

This project is initiated by the USEPA Office of Research and Development, National Homeland Security Research Center (NHSRC), Decontamination and Consequence Management Division (DCMD) in Research Triangle Park, NC. This project is a collaborative effort with the US Centers for Disease Control and Prevention in Atlanta, GA. The U.S. EPA WACOR shall be Dr. M. Worth Calfee (phone 919-541-7600, email calfee.worth@epa.gov). Dr. Sang Don Lee shall be alternate WACOR.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-002

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base X Option Period Number	1-002

Contractor	Specify Section and paragraph of Contract SOW
JACOBS TECHNOLOGY INC.	1, 2, 5, 6

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Jeff Ryan	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-1437 FAX Number:
Project Officer Name Robin Baily	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Mark Cranley	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Combustion Process Emissions Measurements Methods Development Support
WA #: 1-002 WACOR: Jeff Ryan
Contract #: EP-C-008 Alternate WACOR: Ed Brown

Period of Performance: The period of performance detailed in the Performance Statement of Work (PSW) shall be from April 1, 2016 through March 31, 2017.

Background:

With the implementation of ORD's Path Forward initiative, the Air, Climate, Energy (ACE) research component includes targeted research specifically to support the Program Office's and their emissions measurement methods development needs. This WA is intended to support several research "Tasks" (ACE Tasks 222, 096, and 224) identified in the ACE Research Action Plan. Moreover, this WA is intended to implement research that encompasses multiple OAR emissions measurement methods development topics and needs.

These include:

- Evaluation of Hg and NIST traceable gases to support regulatory compliance
- Evaluation of Fourier Transform Infrared (FTIR) for the measurement/monitoring of organic and inorganic Hazardous Air Pollutants (HAPs)
- Evaluation of performance-based approaches for assessing emissions measurement data quality
- Evaluation of innovative measurement/monitoring approaches and technologies
- Evaluation of EPA's Method 26A ability to quantify and speciate HBr and Br_2 emissions in combustion systems
- Resolution of the fundamental discrepancy between elemental (Hg^0) and oxidized ($HgCl_2$) NIST traceable reference gases.

The purpose of this WA is to conduct research that targets the regulatory research needs identified above. This research support is expected to require laboratory and pilot-plant testing in order to fully understand the quality of the measurement technologies under investigation. An additional purpose of this WA is to support maintenance and operations of the Multipollutant Control Research Facility (MPCRF).

Summary of Objectives:

The overall objective of this project, and therefore the primary focus of this WA, is to demonstrate the readiness and quantitative measurement performance of commercially available, gas analyzers or CEMs for point source monitoring and compliance measurement applications. A desired outcome of this work is to generate data that will support the formal development of emissions monitoring procedures.

Another objective of this WA is to examine the impact on the quality of regulatory compliance Hg emissions measurements where bromine is added to coal prior to combustion to enhance Hg control. This process results in the presence of bromine (HBr and Br_2) in the stack gas which has the potential to impact the quality of compliance measurements, particularly those made by Hg CEMS.

A major component of this research will include the development/evaluation of HBr and Br_2 measurement methods.

Another major objective of this WA is to evaluate FTIR, as well as other innovative monitoring technologies, as a regulatory compliance monitoring tool for select organic and acid gas HAPs. Formaldehyde, benzene, naphthalene and acrolein along with HF and HCN are of primary interest. Technology sensitivity (detection limits), proper wavelengths for quantitation, spectral interferences, status and availability of calibration standards are examples of associated considerations. It is anticipated that this work shall require a combination of theoretical and empirical information gathering including some pilot-plant testing on the MPCRF. An additional objective is to consider potential formal changes to Method 320 and Performance Specification 15 so that a revised versions can be proposed.

Scope of Work:

TASK 1. Work Plan, Reporting, Budget, And WA Management

The contractor shall prepare and deliver to the WA manager (WAM) a work plan and budget within 20 days of WA effective date. The work plan must include a description of how the contractor shall accomplish each task, along with a breakdown of level of effort by professional level per task; a cost breakdown per task, and any underlying assumptions used. The contractor shall conduct activities necessary to manage the WA, including at least weekly communication with the EPA WAM.

TASK 2. Preparation of WA QAPP(s)

Several individual QAPPs are anticipated. These QAPPs shall be developed according to the requirements in Appendix #1 to this Statement of Work. Work involving environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff.

TASK 3. Pilot-Plant Testing to Evaluate M26A Measurement Quality

The contractor shall conduct parametric testing on EPA's Multi-Pollutant Combustion Research Facility (MPCRF) to evaluate the quantitative measurement performance of HCl, Cl_2, HBr and Br_2 using EPA Method 26A. The contractor shall establish representative measurement environments while firing on natural gas and coal combustion conditions as a minimum. As less than ideal measurement performance is anticipated, the contractor shall attempt to chemically understand the reasons for measurement performance, including potential mitigation techniques.

TASK 4. Pilot-Plant Testing to Evaluate UV Measurement of Br_2 and Cl_2

The contractor shall conduct testing on EPA's Multi-Pollutant Combustion Research Facility (MPCRF) using the IMACC UV measurement system to evaluate the ability to measure Br_2 and Cl_2 in a combustion emissions matrix. This will require creating reference spectra from reliable gaseous

Br_2 and Cl_2 sources as well as adding these gases to the duct of the MPCRF while firing on natural gas and coal combustion conditions. This task is directly related to **Task 3** and ideally should be performed concurrently as much as possible.

TASK 5. Evaluation of HAP Measurements by FTIR

The contractor shall conduct laboratory and pilot-scale combustor testing to characterize the measurement performance by FTIR of HAPs which include, but are not limited to: formaldehyde, benzene, naphthalene and acrolein along with HF and HCN. The intent is to gain an indication of the lowest concentrations that can be potentially measured. The combustion environment and associated complexities shall be considered in addition to fundamental aspects such as FTIR system path length, appropriate quantitation wavelength(s) and spectral/data resolution. Quantitative measurement performance shall include evaluation by dynamic spiking. The contractor shall use EPA Method 320 as an initial framework for FTIR measurements. However, the contractor shall consider additional performance-based measurement approaches that may prove superior to those approaches presently contained in Method 320 – the data from these approaches are needed by the WACOR to enable a formal revision to Method 320 by the WACOR. The contractors shall consider the three FTIR systems currently available to the MPCRF.

TASK 6. Evaluation of Performance-Based Measurement Quality Indicating Approaches

The contractor shall conduct testing on EPA's Multi-Pollutant Combustion Research Facility (MPCRF) designed to evaluate the quantitative performance of various probe flow/dilution ratio determination approaches associated with dynamic spiking as an overall measurement performance indicator. This testing shall be performed on CEMS capable and incapable of measuring tracer gases. In addition, the contractor shall conduct testing to examine performance-based testing to evaluate approaches for assessing measurement interferences as well as measurement levels of detection.

TASK 7. Experiments to Resolve the Elemental vs. Oxidized Hg Discrepancy

The contractor shall conduct experiments to further characterize the fundamental differences between NIST traceable solution $HgCl_2$ generators and Hg_0 generators. Ideally, these experiments will indicate which gas standard is accurate and which is not. Should this be the case, the contractor shall propose experiments to determine the reason for the discrepancy.

TASK 8. Combustion Testing of Trace Level VOC Measurement Method

The contractor shall conduct proof-of-concept testing on EPA's Multi-Pollutant Combustion Research Facility (MPCRF) to evaluate the quantitative measurement performance of trace level VOCs using SUMMA cans combined with dynamic dilution of stack gas. The objective of this testing is to determine if this ambient measurement technology can be adapted to stack gas measurements. Testing should utilize performance-based measurement approaches such as those contained in EPA Method 18 (paired measurements, static/dynamic spiking)

TASK 9. Multi-Pollutant Combustion Research Facility – Repair and Operational Support

The majority of the pilot-scale research identified above will take place using APPCD/APTB's Multi-Pollutant Combustion Research Facility (MPCRF). This WA will support the repair, maintenance, and operations of this research facility. This WA will also procure and provide fuel (primarily coal) and fuel storage for daily operations and testing. In addition, this WA will support the repair, maintenance, and operations of this research facility by procuring necessary repair parts (e.g., tubing, fittings, thermocouples, gauges, etc) as well as expendable materials (e.g., filters, reagents, gases, etc). Charges for the repair and maintenance of the MPCRF, including consumable and related purchases shall be tracked separately.

TASK 10. Acquire Training for IMACC FTIR/UV Instrument Testing

The contractor shall arrange to acquire training specific to the IMACC FTIR/UV emissions measurement system. The training is to acquire the expertise necessary to conduct research identified under Tasks 4 and 5 above. The IMACC FTIR/UV emissions measurement system, was acquired by EPA only recently and is complicated to learn and operate. Moreover, it is a very unique system requiring specialized expertise that the contractor has not yet obtained. The contractor shall estimate the costs associated with acquiring this training separately and shall not implement this training without written concurrence from the WACOR to do so.

Deliverables and Schedule

Multiple deliverables are required as a function of this WA. These include, but are not limited to:

- Preparation of necessary QAPPs/QATPs (currently 2 are identified: QAPP 1 for M26A/Br/FTIR testing; QAPP 2 for Hg trap testing) – *4/29/16*
- Draft Data Reports - Test data summaries for each test series, including brief summaries of associated testing activities and procedures, copies of all ancillary data forms and log sheets – *within 2 weeks of testing completion*
- Final Data Reports – All raw and summarized measurements data, QA/QC report of data quality and data limitations, if any – *schedule TBD in writing by WACOR.*

Data Reporting Requirements

Data from all tests will be reported in electronic files. They will be assembled in individual Excel notebooks that are unique for each test. Each Excel notebook will consist of:

- Summary page to summarize relevant information from the test
- Narrative page that will give a description of the test, analytical method, deviations from operating procedures during the analysis, deviations from specifications in the test plan or QAPP, problems encountered during the test or analysis, questions or issues concerning individual data points, special actions taken to verify data, data that should be further evaluated by the reviewer, and questions and issues to be addressed in preparation of the final data summary and report

- Data pages which contain all of the raw data as compiled by the individual instruments for field samples, lab samples, and QC samples
- QA/QC pages in which all pertinent QA/QC data are presented

QA/QC Requirements

Multiple QAPPs will be required for this WA. The QAPPs shall be developed according to the requirements in Attachment #1 to this Statement of Work. Work involving environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff.

Reports of Work:

The contractor shall prepare a work plan and budget as described in Task 1 within 20 days of WA effective date. The contractor shall prepare and submit monthly reports in accordance with the terms and conditions of the contract.

Health and Safety Protocols shall be prepared and submitted for approval as required by contractor, APPCD, and SHEM safety personnel.

The contractor shall maintain at least weekly communications with the WAM. Additionally the contractor shall inform the PO and the WAM in writing when 75% of the total funds and/or hours contained in the work plan are expended.

ATTACHMENT #1 TO THE STATEMENT OF WORK (SOW) FOR MEASUREMENT & METHOD DEVELOPMENT PROJECTS

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function;
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function; 07/14/08 A-2
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

□ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X **QAPP Requirements for Measurement Projects**

□ **QAPP Requirements for Secondary Data Projects**

□ **QAPP Requirements for Research Model Development and/or Application Projects**

□ **QAPP Requirements for Software Development Projects**

X **QAPP Requirements for Method Development Projects**

□ **QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

---

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.
4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.
4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
4.5 Describe the method for uniquely numbering each sample.
4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5 MEASUREMENT PROCEDURES

5.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.
5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6 QUALITY METRICS (QA/QC CHECKS)

6.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.
6.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7 DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.
7.2 Describe data validation procedures used to ensure the reporting of accurate project data.
7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).
7.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.
7.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.
7.4 Describe data storage requirements for both hard copy and electronic data.

8 REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.
8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

NRMRL QAPP REQUIREMENTS FOR METHOD DEVELOPMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Provide a description of the situation that requires the generation of a new or modified method.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Identify the specific analyte(s) of interest and the matrix/matrices under study.
3.2 Identify the analytical approach that will be used and how it will be optimized for this study. Also describe any tests of interference and analyte stability.
3.2 Identify the method performance metrics (QA/QC checks) that will be used to evaluate the method, including the procedures used. These metrics could include (but are not limited to) positive and negative controls, sensitivity, precision, accuracy, recovery, linearity, specificity, robustness, and range.

4. SAMPLING PROCEDURES

4.1 Provide the requirements for samples that will be used to test the method (including matrix and presence/concentration of analytes).
4.2 If synthetic (i.e., laboratory-prepared) samples are used, describe the preparation of these samples.
4.3 If non-synthetic (i.e., real-world sample) samples are used, address the following:
- describe the sampling design that will be used and the steps taken to assure that representative samples are collected
- discuss or reference each sampling procedure
- provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis
- describe procedures for packing and shipping samples, and provisions for maintaining chain-of-custody, as applicable

4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
4.5 Describe the method for uniquely numbering each sample.

5. MEASUREMENT PROCEDURES

5.1 Describe in detail or reference each preparation or analytical procedure to be used, if known. Include steps for preparation, calibration, measurement, quality control, and reporting.
5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6. METHOD PERFORMANCE METRICS

For each method performance metric (QA/QC check) identified in Section 3.2, specify the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

7. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.
7.2 Describe data validation procedures used to ensure the reporting of accurate project data.
7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).
7.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.
7.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.
7.4 Describe data storage requirements for both hard copy and electronic data.

8. REPORTING

8.1 List and describe the deliverables expected from each project participant.
8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report, etc.). If a method/SOP will be developed, specify the required format.

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-003

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017
Base X Option Period Number

Title of Work Assignment/SF Site Name: 1-003

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 1, 2, 6

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance
From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Sue Kimbrough
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-2612
FAX Number:

Project Officer Name Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Work Statement

WA Title: Village Green Project and Citizen Science

WA #: 1-003 WACOR: Gayle Hagler

Contract #: EP-C-15-008 Alternate WACOR: Ron Williams

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

The key objectives of this work assignment are to:

1. Provide maintenance and quality assurance support to existing Village Green Project stations.
2. Develop training materials for the Village Green Project.
3. Develop the "generation 3" Village Green Project system, including integration of new sensors.
4. Continue development and support for deployment of the AirMapper.

BACKGROUND

The Village Green Project is an ongoing effort to place solar- and wind-powered air monitoring stations into community environments. This technology has been revolutionary in providing self-sustaining, high time-resolution, and auto-quality checked data to the public on several pollutants of interest (ozone, particulate matter) and weather. To date, EPA has built, installed, and maintained VGP stations in a number of United States locations, including Hartford, CT; Oklahoma City, OK; Chicago, IL; Durham, NC; Washington, D.C.; Philadelphia, PA; and Kansas City, KS. The Philadelphia, Washington, D.C., Kansas City, Hartford, and Chicago locations incorporated some new design features, including combined solar and wind power, an internal heater triggered to turn on at very low temperatures. Multiple locations also include a small nitrogen dioxide sensor incorporated for evaluation purposes. In addition, one rooftop variation of the design was installed in Hong Kong, China. All the domestic locations have data streaming supported through EPA's AirNow program, while the Hong Kong data is supported by a local university (City University of Hong Kong). More information on the project is available at the public websites – epa.gov/villagegreen (informational site) and airnow.gov/villagegreen (data website). From this previous work, the EPA WACOR has detailed design documents and system operation code that will be provided to the contractor to guide the assembly of new stations. In addition, on the previous WA (0-003) a prototype AirMapper device was developed, which is a small portable

sensor device that acquires data on location (GPS), particle concentrations, noise, temperature, and humidity. The data are displayed on an integrated screen and made available via SD card in a format that is compatible with EPA's RETIGO tool (epa.gov/retigo) for exploration. The AirMapper is a device with potential for both educational use and for research purposes, in allowing the user to map air pollution trends.

SCOPE

The scope of this work assignment is to provided continued maintenance support to the existing network of Village Green Project stations, provide training and training materials supporting the independent operation of Village Green Project stations, develop a "generation 3" Village Green Project station that will be deployed to Houston, TX, and continue development and deployment of the AirMapper device. The specific activities are outlined in the tasks below.

Field data collection described in the following tasks will be conducted as detailed in several Category III or IV QAPPs, which will be provided to the contractor for concurrence. The contractor shall review each QAPP and ensure that it is within the scope of this SOW and that it is adequate for the implementation of this SOW. The contractor work assignment leader and QA officer shall provide written documentation to the WA COR as record that they have reviewed the QAPP and agree that it addresses the needs of this SOW and the requirements in Attachment #1, or the contractor shall respond in writing with suggested revisions to make the QAPP meet the requirements of this SOW and the requirements in Attachment #1. It is the responsibility of the contractor work assignment leader to document this process. Upon receipt of the concurrence, the EPA work assignment manager and QA manager will review and approve each QAPP and they will add their signatures to the signature page. Work involving environmental data collection will not commence without an approved QAPP.

TECHNICAL APROACH/OBJECTIVES

Task 1: Support for the existing Village Green Project stations

The contractor shall provide the following types of maintenance for the VGP stations already existing and after installation:

- For the Durham, NC location – the contractor shall provide all maintenance for the station, including routine quality checks, instrument maintenance, troubleshooting, and back-up data download. The routine maintenance is estimated at eight hours per month and consumables/repair items at $2000 in total.
- For the Philadelphia, Washington, D.C., Kansas City, Hartford, Oklahoma City, Chicago, and, after installation, Houston stations – the contractor shall provide troubleshooting advice to the local agency staff operating the

stations and provide repair/replacement of components. The estimated time regarding remote troubleshooting support to the operator involved is one (1) hour per location, per month or seven (7) hours total per month. In addition, the contractor shall estimate a total of seven (7) trips to sites in the United States for on-site troubleshooting/repair support. Repair materials are estimated at $20,000 in total (e.g., replacement components for power system, air monitoring instrument, LCD screen in the sign, etc.).

- For the Hong Kong location – the contractor shall provide only remote troubleshooting support via email and phone calls to the site partner maintaining the station. The amount of troubleshooting time is estimated at two (2) hours per month.
- For all locations, the contractor shall provide a 1 year supply of air monitor instrument consumables, replacement batteries, and back-up supply of Arduino microprocessor and shields that have had failures in the past. These materials are estimated at $1,000 per location.
- For all locations, the contractor shall provide a quick check each weekday morning to assess the status of the network and determine if remote intervention is needed. This quick check is anticipated to take no more than 0.5 hours per week.

Deliverable 1.1. The contractor shall provide a short monthly report including a log of system general operation and any troubleshooting interactions by the contractor for each station operating in the United States. The report shall include any updates to microprocessor code or system configuration required for troubleshooting.

Task 2: Training support for Village Green Project station operation

To support future independent operation and maintenance of Village Green Project stations, the contractor shall develop an updated system design and operations document that integrates all new design features (e.g., wind turbine, heater, NO_2 sensor) for the variation of Village Green Project stations in existence as of March 2016. This design and operations document shall be at a level of detail at which a third-party could independently build, maintain, and troubleshoot a Village Green Project station. Troubleshooting guides shall go into depth on communications, microprocessor and shields, power system, and instrumentation. The WACOR can provide the original design document drafted for the first prototype built in Durham, NC. In addition, the contractor shall provide a professional video walking through the Village Green Project system design, quality assurance checks, and common troubleshooting steps. This video shall be supplied to each location in a DVD format and also made available for download (e.g., FTP).

Deliverable 2.1. The contractor shall provide a draft technical design document within 90 days of the WA initiation.

Deliverable 2.2. The contractor shall provide a final technical design document within 60 days of receipt of WA COR review comments.

Deliverable 2.3. The contractor shall provide an outline of planned video training to within 120 days of the WA initiation.

Deliverable 2.4. The contractor shall provide a draft video file for the WA COR to review within 60 days of receipt of comments Deliverable 2.3 from the WA COR.

Deliverable 2.5. The contractor shall provide the final video to the WA COR and distributed to each United States partner operating a Village Green Project station by the end of the option period.

Task 3: Development and deployment of "Gen 3" Village Green station

The contractor shall fabricate a generation 3 Village Green station that includes the base set of instruments ($PM_{2.5}$, ozone, wind speed and direction, temperature and humidity) and also incorporates 4 additional pollutant sensors. These sensors shall include the following: nitrogen dioxide, ultrafine particles (UFP), black carbon (BC), and total volatile organic compounds (tVOCs). EPA will provide the BC sensor; the contractor shall acquire all other sensors, after receiving approval from the WACOR for the selected components. The contractor shall provide short-term testing (7 days) of the sensors at the near-road air monitoring site at I-40. For this testing purpose, the sensors can operate independently with temporary data logging and power supply set-ups. The contractor shall integrate all sensors into a new Village Green Project park bench structure and have all sensor data streams transmitted to the Village Green AirNow system as well as stored locally on a memory card. The contractor shall not be responsible for the AirNow data management costs or database changes required to incorporate the new sensor data streams – those are separately supported by EPA. After fabrication, the contractor shall provide for a third-party electrical review of the station. The contractor shall transport and deploy the station at a location in Houston, TX determined by the WA COR. The contractor shall provide all preparatory activities to safely install the station and train the local operators in day-to-day management of the station.

Deliverable 3.1. The contractor shall provide the short-term sensor testing data to the WA COR within 90 days of the WA initiation.

Deliverable 3.2. The contractor shall provide an updated design schematic of the generation 3 system, including wiring diagrams and displaying location of sensors / air flow, within 120 days of the WA initiation.

Deliverable 3.3. The contractor shall provide a site installation plan for the Houston station within 45 days of site selection by the WA COR, including engineering drawings of the station, means of securing to ground, and location of station on a site map.

Deliverable 3.4. The contractor shall provide documentation of the successful installation through photos and a spreadsheet documenting on-site quality checks for the Houston station, by the end of the option period.

Task 4: Development and deployment of AirMapper prototypes

The contractor shall provide troubleshooting support to the five AirMapper prototypes that had been delivered to Region 5 under WA 0-003. Each AirMapper originally developed has components (particle sensor, noise sensor, temperature sensor, relative humidity sensor, accelerometer, touchscreen, microprocessor, GPS, case) that total in cost of approximately $1000 per unit. Under technical direction of the WACOR, contractor shall provide design improvements to the AirMapper based upon user feedback, including the physical design of the package, user interface via touchscreen, sensor performance, and data compatibility with RETIGO (epa.gov/retigo). The contractor shall fabricate 10 "generation 2" AirMapper units for use in upcoming field efforts and provide third-party electrical safety review of the generation 2 units. The contractor shall provide an operations and design document of the "generation 2" AirMapper device, after improvements based upon user feedback, which shall include wiring schematics, physical layout of the device, microprocessor code, and step-by-step operations description.

Deliverable 4.1. The contractor shall provide a summary of planned design improvements to the WA COR within 90 days of the WA initiation.

Deliverable 4.2. The contractor shall provide the 10 new AirMapper devices to the WA COR within 90 days of receipt of comments from the WA COR on the design improvements summary.

WA SPECIFIC EQUIPMENT

Tasks 1, 3, and 4 all require procurement of materials and equipment to support the research efforts. Task 1 notes approximately $30,000 in cost to support the station operation – the majority of these costs will be non-accountable property (e.g., instrument consumables or replacement of small components). Task 3 involves the procurement of components to fabricate a new Village Green station for deployment in Houston, TX. The base station cost is known to be approximately 30K in total, with the higher cost items including the bench structure and the two air monitoring instruments. The cost of new sensors to be procured by the contractor (VOCs, NO_2, and UFPs) is estimated to be $45,000 in total. Task involves fabrication of the AirMapper units, which encompass small low cost components that total to $1000 per unit, with the total materials anticipated to be approximately $10,000 for the 10 new AirMapper devices.

ATTACHMENT #1 TO THE STATEMENT OF WORK

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS: Include cover page, distribution list, approvals, and page numbers.

1. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

2. PROJECT DESCRIPTION AND OBJECTIVES

2.1 Describe the process and/or environmental system to be evaluated.
2.2 State the purpose of the project and list specific project objective(s).

3. ORGANIZATION AND RESPONSIBILITIES

3.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
3.2 Include a project schedule that includes key milestones.

4. SCIENTIFIC APPROACH

4.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
4.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
4.3 Describe the general approach and the test conditions for each experimental phase.

5. SAMPLING PROCEDURES

5.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.

5.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.

5.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.

5.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.

5.5 Describe the method for uniquely numbering each sample.

5.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

6. MEASUREMENT PROCEDURES

5.1. Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.

5.2. If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

7. QUALITY METRICS (QA/QC CHECKS)

6.1. For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

6.2. Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

8. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

8.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

8.2 Describe data validation procedures used to ensure the reporting of accurate project data.

8.3 Describe how the data will be summarized or analyzed (e.g., qualitative

analysis, descriptive or inferential statistics) to meet the project objective(s).

8.3.1 If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

8.3.2 If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

8.4 Describe data storage requirements for both hard copy and electronic data.

9. REPORTING

9.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

9.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

10. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-003

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2016
Base Option Period Number 1

Title of Work Assignment/SF Site Name: Amendment 1

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Sue Kimbrough
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-2612
FAX Number:

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name:
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Work Statement – Amendment 1

WA Title: Village Green Project and Citizen Science

WA #: 1-003 WACOR: Sue Kimbrough

Contract #: EP-C-15-008 Alternate WACOR: Ron Williams

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SCOPE:

1. Uninstall and move DC Village Green Station to RTP at the direction of the WACOR. This includes relocation and reestablishment of the DC station including re-establishment of full operating status at the WACOR selected site, an example being within the DC corridor or the RTP area.
2. Provide maintenance and quality assurance support to existing Village Green Project stations.
3. Investigate option(s) for adding three new sensors to Durham bench: solar radiation sensor, CO2 sensor and a BC sensor. The WACOR will select the most feasible option for adding these sensors and the contractor shall implement the most feasible option.
4. Investigate option(s) for retrieving data from new sensors, including but not limited to, adding additional variables to AirNow or other auto data stream.
5. Update and fabricate Durham bench sign to integrate information about new sensors.

WA SPECIFIC EQUIPMENT

Tasks 2-4 all require procurement of materials and equipment to support the research efforts. Task 2 involves procurement of consumables/repair materials in the amount of $2,500. Task 3 involves investigation of implementation options for these three sensors. Assuming Task 3 is feasible, then the procurement of sensors possibly the purchase of a new microprocessor board(s) will be necessary. Estimated cost for the sensors, new board(s) and related materials is $13,000. Task 5 involves fabrication of a new sign for Durham bench to integrate information about new sensors.

Deliverable 1.1. The contractor shall provide written implementation options for Task 3 to the WACOR within 90 days of Amendment 1 to the WA.

Deliverable 1.2. Upon selection of the most feasible option (Task 3) by the WACOR, the contractor shall provide an updated design schematic of the Durham station system, including wiring diagrams and displaying location of sensors / air flow, within 30 days of completion of Deliverable 1.1.

Deliverable 1.3. The contractor will upgrade the Durham bench including sign within 45 days of completion of Deliverable 1.2. The contractor shall provide documentation of the successful installation a spreadsheet documenting on-site quality checks for the station, by the end of the option period.

Deliverable 1.4. The contractor shall provide written implementation options for Task 4 to the WACOR within 30 days of Deliverable 1.2.

END of AMENDMENT 1

Performance Statement of Work

WA Title: Village Green Project and Citizen Science

WA #: 1-003 WACOR: Gayle Hagler

Contract #: EP-C-15-008 Alternate WACOR: Ron Williams

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

The key objectives of this work assignment are to:

6. Provide maintenance and quality assurance support to existing Village Green Project stations.
7. Develop training materials for the Village Green Project.
8. Develop the "generation 3" Village Green Project system, including integration of new sensors.
9. Continue development and support for deployment of the AirMapper.

BACKGROUND

The Village Green Project is an ongoing effort to place solar- and wind-powered air monitoring stations into community environments. This technology has been revolutionary in providing self-sustaining, high time-resolution, and auto-quality checked data to the public on several pollutants of interest (ozone, particulate matter) and weather. To date, EPA has built, installed, and maintained VGP stations in a number of United States locations, including Hartford, CT; Oklahoma City, OK; Chicago, IL; Durham, NC; Washington, D.C.; Philadelphia, PA; and Kansas City, KS. The Philadelphia, Washington, D.C., Kansas City, Hartford, and Chicago locations incorporated some new design features, including combined solar and wind power, an internal heater triggered to turn on at very low temperatures. Multiple locations also include a small nitrogen dioxide sensor incorporated for evaluation purposes. In addition, one rooftop variation of the design was installed in Hong Kong, China. All the domestic locations have data streaming supported through EPA's AirNow program, while the Hong Kong data is supported by a local

university (City University of Hong Kong). More information on the project is available at the public websites – epa.gov/villagegreen (informational site) and airnow.gov/villagegreen (data website). From this previous work, the EPA WACOR has detailed design documents and system operation code that will be provided to the contractor to guide the assembly of new stations. In addition, on the previous WA (0-003) a prototype AirMapper device was developed, which is a small portable sensor device that acquires data on location (GPS), particle concentrations, noise, temperature, and humidity. The data are displayed on an integrated screen and made available via SD card in a format that is compatible with EPA's RETIGO tool (epa.gov/retigo) for exploration. The AirMapper is a device with potential for both educational use and for research purposes, in allowing the user to map air pollution trends.

SCOPE

The scope of this work assignment is to provided continued maintenance support to the existing network of Village Green Project stations, provide training and training materials supporting the independent operation of Village Green Project stations, develop a "generation 3" Village Green Project station that will be deployed to Houston, TX, and continue development and deployment of the AirMapper device. The specific activities are outlined in the tasks below.

Field data collection described in the following tasks will be conducted as detailed in several Category III or IV QAPPs, which will be provided to the contractor for concurrence. The contractor shall review each QAPP and ensure that it is within the scope of this SOW and that it is adequate for the implementation of this SOW. The contractor work assignment leader and QA officer shall provide written documentation to the WA COR as record that they have reviewed the QAPP and agree that it addresses the needs of this SOW and the requirements in Attachment #1, or the contractor shall respond in writing with suggested revisions to make the QAPP meet the requirements of this SOW and the requirements in Attachment #1. It is the responsibility of the contractor work assignment leader to document this process. Upon receipt of the concurrence, the EPA work assignment manager and QA manager will review and approve each QAPP and they will add their signatures to the signature page. Work involving environmental data collection will not commence without an approved QAPP.

TECHNICAL APROACH/OBJECTIVES

Task 1: Support for the existing Village Green Project stations

The contractor shall provide the following types of maintenance for the VGP stations already existing and after installation:

- For the Durham, NC location – the contractor shall provide all maintenance for the station, including routine quality checks, instrument maintenance,

troubleshooting, and back-up data download. The routine maintenance is estimated at eight hours per month and consumables/repair items at $2000 in total.

- For the Philadelphia, Washington, D.C., Kansas City, Hartford, Oklahoma City, Chicago, and, after installation, Houston stations – the contractor shall provide troubleshooting advice to the local agency staff operating the stations and provide repair/replacement of components. The estimated time regarding remote troubleshooting support to the operator involved is one (1) hour per location, per month or seven (7) hours total per month. In addition, the contractor shall estimate a total of seven (7) trips to sites in the United States for on-site troubleshooting/repair support. Repair materials are estimated at $20,000 in total (e.g., replacement components for power system, air monitoring instrument, LCD screen in the sign, etc.).
- For the Hong Kong location – the contractor shall provide only remote troubleshooting support via email and phone calls to the site partner maintaining the station. The amount of troubleshooting time is estimated at two (2) hours per month.
- For all locations, the contractor shall provide a 1 year supply of air monitor instrument consumables, replacement batteries, and back-up supply of Arduino microprocessor and shields that have had failures in the past. These materials are estimated at $1,000 per location.
- For all locations, the contractor shall provide a quick check each weekday morning to assess the status of the network and determine if remote intervention is needed. This quick check is anticipated to take no more than 0.5 hours per week.

Deliverable 1.1. The contractor shall provide a short monthly report including a log of system general operation and any troubleshooting interactions by the contractor for each station operating in the United States. The report shall include any updates to microprocessor code or system configuration required for troubleshooting.

Task 2: Training support for Village Green Project station operation

To support future independent operation and maintenance of Village Green Project stations, the contractor shall develop an updated system design and operations document that integrates all new design features (e.g., wind turbine, heater, NO_2 sensor) for the variation of Village Green Project stations in existence as of March 2016. This design and operations document shall be at a level of detail at which a third-party could independently build, maintain, and troubleshoot a Village Green Project station. Troubleshooting guides shall go into depth on communications, microprocessor and shields, power system, and instrumentation. The WACOR can provide the original design document drafted for the first prototype built in Durham, NC. In addition, the contractor shall provide a professional video walking through the Village Green Project system design, quality assurance checks, and common

troubleshooting steps. This video shall be supplied to each location in a DVD format and also made available for download (e.g., FTP).

Deliverable 2.1. The contractor shall provide a draft technical design document within 90 days of the WA initiation.

Deliverable 2.2. The contractor shall provide a final technical design document within 60 days of receipt of WA COR review comments.

Deliverable 2.3. The contractor shall provide an outline of planned video training to within 120 days of the WA initiation.

Deliverable 2.4. The contractor shall provide a draft video file for the WA COR to review within 60 days of receipt of comments Deliverable 2.3 from the WA COR.

Deliverable 2.5. The contractor shall provide the final video to the WA COR and distributed to each United States partner operating a Village Green Project station by the end of the option period.

Task 3: Development and deployment of "Gen 3" Village Green station

The contractor shall fabricate a generation 3 Village Green station that includes the base set of instruments ($PM_{2.5}$, ozone, wind speed and direction, temperature and humidity) and also incorporates 4 additional pollutant sensors. These sensors shall include the following: nitrogen dioxide, ultrafine particles (UFP), black carbon (BC), and total volatile organic compounds (tVOCs). EPA will provide the BC sensor; the contractor shall acquire all other sensors, after receiving approval from the WACOR for the selected components. The contractor shall provide short-term testing (7 days) of the sensors at the near-road air monitoring site at I-40. For this testing purpose, the sensors can operate independently with temporary data logging and power supply set-ups. The contractor shall integrate all sensors into a new Village Green Project park bench structure and have all sensor data streams transmitted to the Village Green AirNow system as well as stored locally on a memory card. The contractor shall not be responsible for the AirNow data management costs or database changes required to incorporate the new sensor data streams – those are separately supported by EPA. After fabrication, the contractor shall provide for a third-party electrical review of the station. The contractor shall transport and deploy the station at a location in Houston, TX determined by the WA COR. The contractor shall provide all preparatory activities to safely install the station and train the local operators in day-to-day management of the station.

Deliverable 3.1. The contractor shall provide the short-term sensor testing data to the WA COR within 90 days of the WA initiation.

Deliverable 3.2. The contractor shall provide an updated design schematic of the generation 3 system, including wiring diagrams and displaying location of sensors / air flow, within 120 days of the WA initiation.

Deliverable 3.3. The contractor shall provide a site installation plan for the Houston station within 45 days of site selection by the WA COR, including engineering drawings of the station, means of securing to ground, and location of station on a site map.

Deliverable 3.4. The contractor shall provide documentation of the successful installation through photos and a spreadsheet documenting on-site quality checks for the Houston station, by the end of the option period.

Task 4: Development and deployment of AirMapper prototypes

The contractor shall provide troubleshooting support to the five AirMapper prototypes that had been delivered to Region 5 under WA 0-003. Each AirMapper originally developed has components (particle sensor, noise sensor, temperature sensor, relative humidity sensor, accelerometer, touchscreen, microprocessor, GPS, case) that total in cost of approximately $1000 per unit. Under technical direction of the WACOR, contractor shall provide design improvements to the AirMapper based upon user feedback, including the physical design of the package, user interface via touchscreen, sensor performance, and data compatibility with RETIGO (epa.gov/retigo). The contractor shall fabricate 10 "generation 2" AirMapper units for use in upcoming field efforts and provide third-party electrical safety review of the generation 2 units. The contractor shall provide an operations and design document of the "generation 2" AirMapper device, after improvements based upon user feedback, which shall include wiring schematics, physical layout of the device, microprocessor code, and step-by-step operations description.

Deliverable 4.1. The contractor shall provide a summary of planned design improvements to the WA COR within 90 days of the WA initiation.

Deliverable 4.2. The contractor shall provide the 10 new AirMapper devices to the WA COR within 90 days of receipt of comments from the WA COR on the design improvements summary.

WA SPECIFIC EQUIPMENT

Tasks 1, 3, and 4 all require procurement of materials and equipment to support the research efforts. Task 1 notes approximately $30,000 in cost to support the station operation – the majority of these costs will be non-accountable property (e.g., instrument consumables or replacement of small components). Task 3 involves the procurement of components to fabricate a new Village Green station for deployment in Houston, TX. The base station cost is known to be approximately 30K in total, with the higher cost items including the bench structure and the two air monitoring instruments. The cost of new sensors to be procured by the contractor (VOCs, NO_2, and UFPs) is estimated to be $45,000 in total. Task

involves fabrication of the AirMapper units, which encompass small low cost components that total to $1000 per unit, with the total materials anticipated to be approximately $10,000 for the 10 new AirMapper devices.

ATTACHMENT #1 TO THE STATEMENT OF WORK

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS: Include cover page, distribution list, approvals, and page numbers.

1. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

2. PROJECT DESCRIPTION AND OBJECTIVES

2.1 Describe the process and/or environmental system to be evaluated.
2.2 State the purpose of the project and list specific project objective(s).

3. ORGANIZATION AND RESPONSIBILITIES

3.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
3.2 Include a project schedule that includes key milestones.

4. SCIENTIFIC APPROACH

4.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
4.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
4.3 Describe the general approach and the test conditions for each experimental phase.

5. SAMPLING PROCEDURES

5.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.

5.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.

5.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.

5.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.

5.5 Describe the method for uniquely numbering each sample.

5.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

6. MEASUREMENT PROCEDURES

5.1. Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.

5.2. If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

7. QUALITY METRICS (QA/QC CHECKS)

6.1. For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

6.2. Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

8. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

8.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

8.2 Describe data validation procedures used to ensure the reporting of accurate project data.

8.3 Describe how the data will be summarized or analyzed (e.g., qualitative

analysis, descriptive or inferential statistics) to meet the project objective(s).

8.3.1 If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

8.3.2 If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

8.4 Describe data storage requirements for both hard copy and electronic data.

9. REPORTING

9.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

9.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

10. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-005

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name: 1-005

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 2, 6

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Michael Hays
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-3984
FAX Number:

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name:
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

1-005
EP-C-15-008

Performance Work Statement (Period of performance: 4/1/2016 – 3/31/2017)

I. **Title:** Analytical laboratory support for the physical and chemical characterization of organic gases and PM2.5

II. **Background:** The Air Pollution Prevention and Control Division's (APPCD) Emissions Characterization and Prevention Branch (ECPB) conducts research on fine particulate matter (PM2.5) and aerosol emissions as they pertain to the implementation of the National Ambient Air Quality Standards (NAAQS). Measurement of the physical and chemical properties of both gas- and particle-phase emissions is a research priority for ECPB. These measurements are used as input to National emissions inventories and to establish global air quality trends and to understand related public health effects. Chemical source profiles are also used in source-receptor models that apportion ambient gases and PM2.5 to various anthropogenic and natural emissions sources. NRMRL-ECPB aims to characterize gas- and particle-phase source emissions and to develop and evaluate methods to measure and prevent these emissions. This Work Assignment seeks to update and upgrade source emissions profiles and PM2.5 mass emissions factors while improving the quality of data used for dispersion and source-receptor modeling and for evaluating current risk management and regulatory strategies.

In sum, the objectives of this project are to physically and chemically characterize source-related gas and PM2.5 samples for: (i) gathering and improving chemical source profiles; (ii) accurately apportioning ambient organic matter; (iii) improving fine PM mass and individual gas and PM component emission factors; and for (iv) supporting health and toxicological research.

III. **Work Assignment Objective:** The objective is to provide the Fine PM Characterization Laboratory (FPMCL) technical support for the chemical characterization of PM2.5 filter samples collected from a variety of important sources, especially, but not exclusively, combustion sources. Support for semi-volatile organic compounds (SVOCs) and gas-phase samples collected on polyurethane foam plugs (PUFs), SUMA canisters, and similar sampling media or devices shall also be provided. The contractor shall be responsible for the characterization of (1) gas- and particle-phase emissions from residential- and industrial-scale boilers and (2) samples from emissions tests conducted with jet engines and with vehicles or generators burning diesel, bio-diesel, and ethanol-gas fuel blends. Characterization of near-source samples including those collected near roadways, biomass burning, industrial or commercial activities or similar polluted environments shall be necessary. Before analysis of any sample set the contractor shall seek the technical direction of the WA task manager. In some cases, the WA task manager will direct the contractor to provide samples to other authorized laboratory personnel for specialized sample analysis. An additional objective shall be to provide the WA task manager with a written report on a monthly basis or upon completion of the chemical and physical characterization of an emissions source.

IV. **Scope-of-Work:** In fulfillment of the objectives of this Work Assignment, the following Tasks listed below shall be performed by the Contractor, and throughout the course of performing these Tasks, the Contractor shall comply with (1) an approved QAPP, a QAPP to be submitted for approval, or a QAPP or approved Method from similar previous work. QAPPs shall be provided by the WACOR and may aid in new QAPP development; (2) all relevant QAPP addendums and (3) the FPMCL Facility Manual. All work will be conducted using these existing documents. Moreover, the contractor shall follow all issued standard operating procedure (SOP), chemical hygiene, and Laboratory related health and safety plans.

V. In accordance with laboratory protocols established by the EPA for analysis of volatile and semi-volatile organic gases and PM2.5 samples, the contractor shall acquire laboratory supplies and consumables needed to accomplish the technical laboratory support work described below. The analytical protocols will be provided to the Contractor by the EPA Work Assignment Manager prior to initiation of the technical work.

A. The contractor shall determine the purity of each new lot of extraction solvents and, as necessary, purify any solvents that may be contaminated by commercial practices. The solvents shall be of sufficient purity to enable extraction and analysis of the samples and shall not contain interfering contaminants that may detract from the Data Quality Objectives of the project. The Data Quality Objectives are to be specified in the project QAPPs as stated above. The purity of the solvent shall be documented by the contractor and identification of the solvent lot used for sample extraction shall be reported by the contractor. The contractor shall include this information in the monthly written progress reports. Or this information shall be contained in the final report written for each source following the completion of its characterization. Biological fluids such as simulated lung or gastric fluids or bronchial lavage fluids may also be used as part of this project.

B. The contractor shall clean substrates, sampling train components, and sample containers for collection of gases,

liquids, and PM2.5, for field deployment, or for in-house sampling campaigns. Sample substrates and blanks may include Teflon membrane and quartz fiber filters, XAD-coated annular denuders, aluminum foil, XAD impregnated quartz filters, glass beads, PUF (polyurethane foam plugs) and various SUMA canisters. Also, the contractor shall provide clean glassware for use in the analyses of the PM samples. Decontamination methods will involve various solvent rinses and/or high temperature thermal removal of contaminants as described in the facility manual.

C. The contractor shall condition and weigh Teflon filters and Al foil substrates before and after PM sample collection in accordance with established EPA weighing procedures and quality control.

D. The contractor shall maintain a sample custody log of samples submitted for analysis following sample collection. For the vast majority of cases, it shall be necessary for a number of individual samples from a single source to be composited, thereby requiring careful recording of the composited samples. Before samples are composited, the contractor shall notify the WAM of the intention to do so. The WAM will also notify the contractor of the analytical method to be applied prior to analyzing any sample set.

E. Using protocols established and supplied by the EPA Work Assignment Manager, the contractor shall perform solvent or thermal extractions of particulate matter and semi-volatile organic matter samples collected on various media substrates. Samples shall be prepared so that analyte concentrations are appropriate for precise and accurate quantitative analysis of individual trace organic compounds and major inorganic ions. Once the individual species are identified and quantified in the PM mixture, the contractor shall report the raw and processed data and appropriate proof of the data quality to the WAM. The contractor shall also be responsible for running library searches on chromatographic data for the tentative identification of organic molecules in the PM extracts. The results of each search shall be reported by the contractor and compared against an appropriate blank to ensure validity. For quantified compounds, the contractor shall report whether (1) standards were available, (2) the compounds were within the calibration range, (3) the quantified compounds were above or below minimum detectable or quantifiable levels, and (4) the type of model used to fit calibration data. The contractor shall perform an identical set of functions for the gas-phase pre-concentration system used to analyze volatile organic compounds (VOCs), many of which are hazardous air pollutants.

F. Following a procedure established and provided by the EPA Work Assignment Manager, the contractor shall perform derivatization of polar organic compounds that enables quantitative resolution of such compounds via gas chromatography/mass spectrometry. Suitable standards shall also be derivatized by the contractor and used to (1) estimate deuterated standard recoveries (by making multiple GC/MS runs of the deuterated standards during a sample run sequence) and (2) to populate appropriate calibration database levels. Documentation of data quality for the derivatization steps shall be performed by the contractor. This data quality documentation shall be linked to specific PM extract samples analyzed by GC/MS. The contractor shall purchase derivatization equipment needed to conduct *on-line* or *in-situ* methylation and silyatoin experiments. Purchased equipment shall be compatible with the GC-MS technology and instrumentation available in the FPMCL and shall include an auto-sampler device.

G. The contractor shall provide for appropriate handling and disposal of all laboratory waste solvents and other laboratory waste materials.

H. The contractor shall operate, maintain, and modify, as necessary, analytical instrumentation and ancillary equipment in the EPA FPMCL. (Note: this Task includes ensuring appropriate instrument gases are provided (e.g., He, H_2, N_2, and air). The contractor shall maintain a file of operating manuals for all equipment and instruments. Equipment and instruments included in this Task are:

- HP-7890/7000 Auto sampler/Gas Chromatograph/MSD (qqq) in Room E580-A
- HP-6890/5793 Thermal extraction unit/Gas Chromatograph/MSD/FID in E580-A
- HP-6890/5793 Thermal extraction unit/2-dimensional Gas Chromatograph/MSD/ in E589-A
- HP-6890/5793 VOC pre-concentrator (ENTECH Inc) Gas Chromatograph/MSD/ in E288
- HPLC-MS (Q-TOF) and N_2-generator in E589
- Zymark TurboVap solvent concentrator in E580-A
- Cryofreezer in E580
- Fisher Isotemp muffle furnance in E569
- Skutt ceramic kiln in E578-A
- Nuaire horizontal clean bench in E578-A
- Sunset Thermal-Optical Elemental/Organic Carbon Analyzers in E-581-A and E589
- Thelco convection oven in E581-A

- Ainsworth semi-micro balance in E581-A or high-bay area
- Dionex 120 ion chromatograph in E581-A
- Sartorius MC5 microbalance in E580-A
- Cahn ultra microbalance in E580-A
- Terra Universal modular clean room in E580-A
- Dracor water purification system in E581-A
- Frigidaire commercial freezer and additional cryo-freezer units in E578
- Domnic-Hunter hydrogen generators (2) in E581-A

L. The contractor shall maintain a complete and up-to-date chemical inventory for the FPMCL Facility along with Material Safety Data Sheets for all chemicals.

M. The contractor shall update, as needed, the Facility Manual for the PM2.5 Analytical Facility which includes as a minimum the following items:

- General facility lay-out
- List of equipment by name, serial and model no, custodial account ID, EPA decal no., and location
- Computer software and hardware
- Safety/Health protocols
- Quality Assurance and Control protocols
- Sampling and Analysis Methods (ASTM, EPA, Miscellaneous Operating Procedures)

N. With the exception of the miscellaneous operating procedures (MOPs) for cleaning sample substrates, laboratory glassware, and sampling train components for which the Contractor shall be responsible, the QA/QC protocols, analytical protocols, and other MOPs will be provided by the EPA Work Assignment Manager for incorporation into the Facility Manual. The Facility Manual is a working document and will incorporate new material as protocols are established or modified and additional equipment is acquired.

O. The contractor shall supply to the WAM on a monthly basis a written progress report that includes: (1) a list by identification number of the samples analyzed; (2) the type of analysis done; (3) the results and data analysis; (4) a brief interpretation of the results; (5) future work planned in the laboratory; (6) proof of data quality; (7) description of experimental procedure used and any observed anomalous behavior; and (8) description of laboratory operations; The contractor shall also provide to the WAM electronic copies of completed data sets and data analysis by source. In the event that the analysis of sample substrates from a single test source are completed, the contractor shall produce a written report describing the results of the analysis, the source sampling test conditions, and any other pertinent particle sizing and/or counting data.

VI. Labor mix: To achieve the objectives of the WA the following labor mix is required: (1) a person with extensive experience in chemical analysis using chromatography (GC-MS/FID, LC-MS, etc.). This individual shall have at least 15 years of GC-MS experience and be familiar with the extraction and pre-concentration procedures used for PM and miscellaneous organic gases. This individual shall be responsible for GC-MS (qqq) analysis and interpretation of GC-MS data as stated above. This person shall be capable of following all the required QA/QC procedures established in any relevant QA protocols and shall be required to communicate results to the WA task manager. This individual shall also be responsible for certain research pursuits as they relate to the analysis of GC-MS data, including library searches and the application of identified deconvolution algorithms. The contractor shall ultimately be responsible for all of the GC-MS data quality provided to the WA task manager. (2) an individual who assists with extractions, sampling and media pretreatment and sample handling, and other similar logistical tasks shall occasionally be needed.

VII. Equipment purchase: The contractor shall look into the possibility of further automating the micro-solvent extraction, filtering, and concentration techniques. In consultation with the WAM, the contractor shall purchase technology that improves the analytical sample throughput or speed at which these steps can be conducted. Additional sampling equipment shall also be purchased in the event there is a need to complete a project in a timely manner.

VIII. Deliverables: The contractor shall deliver: (1) an analytical report and data worksheet containing SVOC emission factors for an outdoor pellet boiler burning grass and corn stover pellets (due on or before September 1, 2016); (2) a methods report and data worksheet containing SVOC emission factors for a dynamometer study investigating gasoline direct injection vehicles (due on or before January 1, 2017); a report detailing further development for a novel physiological-based extraction method using saline and lung fluids developed for better PM dosimetry (due on or before March 31, 2017).

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-006

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Jim Jetter
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-4830
FAX Number:

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Cookstove Emissions and Fuel Efficiency Research

WA #: 1-006 WACOR: Jim Jetter

Contract #: EP-C-15-008

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017. This work is a continuation of the project started under WA 0-006.

SUMMARY OF OBJECTIVES

The primary objective of this WA (work assignment) is to measure energy efficiency and air pollutant emissions from practical, fuel-efficient, "cleaner-burning" cookstoves. Pollutant emissions from "cleaner-burning" solid-fuel stoves shall be compared to emissions from the traditional "three-stone" fire, as well as to emissions from liquid- and gas-fueled stoves. This study provides stove emissions information that will be valuable to Global Alliance for Clean Cookstoves (the Alliance) partners disseminating stove technology in the field. Additionally, this study is exploring how cookstove performance and emissions are affected by conditions including fuel moisture content, fuel size and shape, operator technique, weather conditions, pot size and shape, and stove durability. Results from this study will support the development of testing protocols and standards through ISO Technical Committee 285, Clean Cookstoves and Clean Cooking Solutions. This work also provides technical support for the development of Regional Testing and Knowledge Centers, many of which are sponsored by the Alliance. Stoves to be tested are identified below.

BACKGROUND

This work is part of EPA's commitment in support of the Global Alliance for Clean Cookstoves. The Alliance was launched after ten years of foundational work conducted by the EPA-led Partnership for Clean Indoor Air (now integrated with the Alliance). The Alliance is a public-private partnership that seeks to save lives, improve livelihoods, empower women, and protect the environment by creating a thriving global market for clean and efficient household cooking solutions. Its ambitious goal is to foster the adoption of clean cookstoves and fuels in 100 million households by 2020. For more information, see the Alliance web site at: http://www.cleancookstoves.org/

The WHO (World Health Organization) estimates that household air pollution mainly from solid-fuel cookstoves causes more than 4 million premature deaths annually – greater than the combined impact of HIV, malaria, and tuberculosis globally. Cookstove emissions of black carbon, brown carbon, organic carbon, CO_2, and methane also affect global climate change.

Reducing household air pollution associated with burning solid fuels provides multiple benefits. Human health is improved through better indoor air quality and ambient air quality. Sustainability and ecology are promoted through reduced deforestation and protection of biodiversity. Global climate change is addressed through reduced emissions of greenhouse gases and other climate forcers. International relations are improved through collaboration with partners.

SCOPE

The scope of this WA includes operation of research facilities, testing of stoves and fuels, gravimetric filter sample analysis, data processing and analysis, and other activities, as described in detail below.

TECHNICAL APPROACH /OBJECTIVES

Operation of research facilities. The contractor shall operate an existing cookstove test facility in the EPA High Bay Building (Room H-106). This system has capabilities for testing stoves with tall chimneys and for measuring emissions at various dilution ratios. The contractor shall operate, maintain, and repair the facilities, as needed. EPA will provide instrumentation. The contractor shall provide continuous improvement of the system, as needed, to meet QA requirements, improve efficiency of operations, and improve general quality.

Testing of stoves and fuels. The EPA WACOR will obtain the stoves and will specify which stoves will be tested. The Contractor shall operate the stoves during the testing. This work is a continuation of the project started under WA 0-006, and stoves to be tested will include the following types:

- Gasifier-type, rocket-type, and charcoal-fuel-type stoves identified for round-robin testing in coordination with the Global Alliance for Clean Cookstoves, Regional Testing and Knowledge Centers
- Three advanced technologies developed through the U.S. Department of Energy's cookstove research program
- Two stoves to be identified in a joint U.S. – China Ministry of Science and Technology (MOST) project. The two stoves shall be tested with the WBT (Water Boiling Test) Version 4.2.3 (described below) as well as the China test protocol: http://cleancookstoves.org/technology-and-fuels/testing/protocols.html

- Stoves to be tested experimentally to support development of international protocols and standards through ISO Technical Committee 285 – Clean Cookstoves and Clean Cooking Solutions
- Additional test replications required for meeting QA requirements for stoves previously tested.
- LPG (liquified petroleum gas) stoves operated under various conditions and with various blends of propane and butane.

Total number of stove/fuel combinations to be tested: 40 total with completion of 2 per month.

Fuels to be tested. Wood-burning stoves shall be tested with high- and low-moisture hardwood, red oak, fuel. Freshly cut "green" red oak firewood without bark, lengths approximately 14", will be obtained from a local vendor. The wood shall be cut on a table saw and/or band saw to produce sticks that shall be approximately 2 cm x 2 cm in cross section. Half of the fuel wood shall be air dried to a moisture content of approximately 10 percent (on a wet basis), and the other half of the fuel wood shall be stored in air-tight barrels in a freezer to keep the moisture content at approximately 30 percent.

The charcoal stoves shall be tested with "lump" charcoal (not compressed briquettes) similar to that available in developing countries. Stoves shall be tested with "dry" charcoal (approximately 5 percent moisture content on a wet basis). Charcoal stoves shall be tested following guidelines available from the Global Alliance for Clean Cookstoves web site:
http://cleancookstoves.org/binary-data/DOCUMENT/file/000/000/401-1.pdf

All fuels shall be analyzed for moisture content using ASTM Standard Method D4442-07. Moisture content of the fuels shall be measured on each day of testing. A random sample of fuel wood, with a mass of approximately 100 g, shall be weighed with an electronic balance. The sample shall be dried in a ventilated oven for at least 8 hours, and then the sample shall be weighed periodically until no mass change is detected. The percent moisture content in the wood on a percent wet basis shall be calculated and recorded.

All fuels shall be analyzed for heat of combustion using ASTM Standard Method ASTM D5865-04. This testing shall be done by a qualified outside laboratory.

Air pollutants to be measured. The contractor shall measure emissions of the following pollutants for each stove and fuel combination:

- CO2 - real-time, CEM (IR)
- CO - real-time, CEM (IR)
- PM2.5, measured gravimetrically, filter sample taken during each of the three phases of the WBT (Water Boiling Test – see below)
- BC (black carbon) – real-time with aethalometer
- EC (elemental carbon) and OC (organic carbon) – quartz filter sample taken during each of the three phases of the WBT and analyzed with the thermal-

optical method. Quartz "back-up" filter sample also taken during each WBT phase to quantify the gas-phase artifact

- PM, submicrometer particles measured with SMPS (scanning mobility particle sizer)
- THC (total hydrocarbon) - real time, FID total HC analyzer
- CH4 (methane) - real time, FID analyzer
- Other pollutants may be added if resources (instruments and personnel) are available

The EPA will furnish instrumentation and equipment necessary to measure air pollutants.

BC/EC/OC analysis will be provided by EPA Emissions Characterization and Prevention Branch, contact: Michael Hays

Test protocol. WBT (Water Boiling Test) Version 4.2.3 available at: http://cleancookstoves.org/technology-and-fuels/testing/protocols.html

A summary of the performance test protocol follows:

"This modified version of the well-known Water Boiling Test (WBT) is a simulation of the cooking process that can be performed on most stoves in use throughout the world. While the test is not intended to replace other forms of stove assessment, it is designed to be a simple method by which stoves made in different places and for different cooking applications may be compared by a standardized and replicable protocol."

"The WBT ...consists of three phases.

1) In the first phase, the tester begins with the stove at room temperature and uses a pre-weighed bundle of wood to boil a measured quantity of water in a standard pot. The tester then replaces the boiled water with a fresh pot of cold water to perform the second phase of the test.

2) In the second phase, water is boiled beginning with a hot stove in order to identify differences in performance between a stove when it is cold and when it is hot.

3) Lastly, the tester again boils a measured amount of water and then, using a pre-weighed bundle of wood, simmers the water at just below boiling for a measured period of time (45 minutes). The third step simulates the long cooking of legumes or pulses that is common throughout much of the world."

"This combination of tests is intended to measure the stove's performance at both high and low power outputs, which are important indicators of the stove's ability to conserve fuel."

Gravimetric filter sample analysis. The contractor shall perform gravimetric filter analysis for $PM_{2.5}$ using EPA facilities in Room E-487. The contractor shall perform manual or robotic weighing of the filters.

Data analysis. The contractor shall provide support for processing and analyzing data from the cookstove tests conducted under this WA. The contractor shall work closely with the EPA WACOR. The contractor shall use DASYLab software for data acquisition and Microsoft Excel spreadsheets for processing data. Microsoft Access may be used in the future for managing data. The contractor-provided support shall include QA checks of manual data entry, importing raw data into "daily data" spreadsheets, importing processed data from "daily data" spreadsheets into "stove/fuel spreadsheets," evaluating carbon balance calculations, and final QA checks. The contractor shall identify tests that do not meet QA requirements, and repeat tests if necessary. This work will be described in a QAPP (Quality Assurance Project Plan) and associated MOPs (see below). The work will be coordinated with the EPA WACOR, and the EPA WACOR will provide further details.

The contractor shall use the automated system that has been developed to enable immediate data processing following each stove test (not including analysis of samples that require post-processing, e.g., filter samples).

Results. The contractor shall deliver data to the EPA WACOR in Microsoft Excel files that can be easily analyzed. Results shall be reported as averages and standard deviations for the three tests for each stove. The contractor shall report data including all parameters in the WBT test protocol, and the data shall be in format similar to that used in previous testing.

SAFETY

The Contractor shall comply with a Health and Safety Protocol. The Contractor shall maintain a safe working environment during testing.

QUALITY ASSURANCE

A new QAPP (Level II) will be prepared and submitted for approval, and a QAPP for a similar previous work will be provided by the WACOR to aid in the development of the new QAPP. Internal technical systems audits have previously been completed, and the project was approved by an EPA internal quality assurance review. An internal audit of data quality was also previously performed, and a second audit is in progress. If any revision of the QAPP (and associated MOPs) is required, the QAPP shall be reviewed and approved by the JTI work assignment leader and QA officer. Once it has obtained their approval, it shall be submitted to the EPA QA staff for review and approval. It shall be accompanied by a signature page that is signed by the JTI work assignment leader and QA officer to show that they have

reviewed and approved the revised QAPP. It is the responsibility of the JTI work assignment leader to document this process. Upon receipt of the signed QAPP, the EPA work assignment manager and QA manager will review and approve the QAPP and they will add their signatures to the signature page. Any work involving environmental data shall not commence until the QAPP has received official approval from the EPA QA staff.

See: ATTACHMENT #1 TO STATEMENT OF WORK FOR QA CATEGORY II PROJECTS.

DELIVERABLES

The Contractor shall prepare and deliver brief, monthly progress reports in accordance with the reporting requirements in the contract. The contractor shall deliver data and filter samples to the EPA WACOR. The final report will be prepared by the EPA WACOR and will be in the form of EPA reports and a manuscript to be submitted to a peer-reviewed journal for publication. Contractor personnel may be coauthors of the publications.

SCHEDULE of DELIVERABLES

Raw test data, filter samples, and processed data shall be deliverables.

Schedule is as follows:

January 31, 2017	Complete cookstove testing
February 28, 2017	Deliver all filter samples and raw test data
March 31, 2017	Complete data analysis and quality assurance, and deliver all processed data

ATTACHMENT #1 TO STATEMENT OF WORK FOR QA CATEGORY II PROJECTS

NRMRL QA Requirements and Definitions

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation described herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The QAPP shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government.

Definitions:

Environmental Data - These are any measurements or information that describe environmental processes, location, or conditions; ecological or health effects and consequences; or the performance of environmental technology. For EPA, environmental data include information collected directly from measurements, produced from software and models, and compiled from other sources such as data bases or the literature.

Quality Assurance (QA) - Quality assurance is a system of management activities to ensure that a process, item, or service is of the type and quality needed by the customer. It deals with setting policy and running an administrative system of management controls that cover planning, implementation, and review of data collection activities and the use of data in decision making. Quality assurance is just one part of a quality system.

Quality Assurance Project Plan (QAPP) - A QAPP is a document that describes the necessary quality assurance, quality control, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. A QAPP documents project-specific information.

Quality Control (QC) - Quality control is a technical function that includes all the scientific precautions, such as calibrations and duplications, that are needed to acquire data of known and adequate quality.

Quality Management Plan (QMP) - A QMP is a document that describes an organization's/program's quality system in terms of the organizational structure, policy and procedures, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, documenting, and assessing all activities conducted. A QMP documents the overall organization/program, and is primarily applicable to multi-year, multi-project efforts. An organization's/program's QMP shall address all elements listed in the "Requirements for Quality Management Plans" in Appendix B of the NRMRL QMP.

Quality System - A quality system is the means by which an organization manages its quality aspects in a systematic, organized manner and provides a framework for planning, implementing, and assessing work performed by an organization and for carrying out required quality assurance and quality control activities.

R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001
http://www.epa.gov/quality/qs-docs/r5-final.pdf

Substantive Change - Substantive change is any change in an activity that may alter the quality of data being used, generated, or gathered.

EPA's Quality System Website: http://www.epa.gov/quality/

EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function;
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

Category Level Designations (determines the level of QA required):

□ **Category I Project** - applicable to studies performed to generate data used for enforcement activities, litigation, or research project involving human subjects. The QAPP shall address all elements listed in R-5.

X **Category II Project** - applicable to studies performed to generate data used in support of the development of environmental regulations or standards. The QAPP shall address all elements listed in R-5.

□ **Category III Project** - applicable to projects involving applied research or technology evaluations. The QAPP shall address the applicable sections of R-5, as outlined in the NRMRL QAPP requirements for the specific project type.

□ **Category IV Project** - applicable to projects involving basic research or preliminary data gathering activities. The QAPP shall address the applicable sections of R-5, as outlined in the NRMRL QAPP requirements for the specific project type.

Suggested Content for Required Elements of QA Project Plans as per R-5:

GROUP A PROJECT MANAGEMENT

There are nine elements in this group. These address project administrative functions and project concerns, goal(s), and approach(es) to be followed.

Element A1- Title and Approval Sheet

- Project title
- Organization name
- Names, titles, signatures, and signature dates of the approving officials

Element A2- Table of Contents

- Table of Contents;
- List of Figures, Tables, References and Appendices
- Document control format

Element A3- Distribution List

Names of individuals and organization(s) to receive a copy of the approved QA Project Plan

Element A4- Project/Task Organization

- List of individuals and organizations involved with the project, identifying their roles and responsibilities
- Documentation of project QA Manager's independence
- Identification of the individual responsible for maintaining the official, approved QA Project Plan
- Organizational chart showing relationships and lines of communication among project personnel

Element A5- Problem Definition/Background

- Statement of specific problem to be solved, decision to be made, or outcome to be achieved
- Background information

Element A6- Project/Task Description

- Summary of work to be performed and products
- Project schedule
- Maps, tables, etc. showing geographic locations

Element A7- Quality Objectives and Criteria

- Outputs from the systematic planning process (e.g., DQOs) used to design the study
- Measurement performance or acceptance criteria established as part of the study design. These relate the quality of data needed to the established limits on the chance of making a decision error or of incorrectly answering a study question

Element A8- Special Training/Certifications

- Description of how the most current approved QA Project Plan will be distributed to project staff
- List of records to be included in the data report package
- List of any other project documents to be produced
- Information on the final disposition of records and documents, including location and retention schedule

Element A9- Documentation and Records

- Any specialized training or certifications needed by personnel
- Plans for providing, documenting, and assuring this training

GROUP B: DATA GENERATION AND ACQUISITION

The ten elements in this group address data generation and data acquisition and management activities.

Element B1- Sampling Process Design (Experimental Design)

Description of project's experimental design

Element B2- Sampling Methods

- Description of sample/data collection procedures
- List of equipment needed
- Identification of performance requirements
- Description of corrective actions to be taken if problems arise

Element B3- Sample Handling and Custody

Description of sample handling requirements and transfer, and for ultimate disposal

Element B4- Analytical Methods

- Description of analytical methods to be used
- Identification of any performance criteria
- Description of corrective actions when problems arise

Element B5- Quality Control

- List of QC activities needed for sampling, analytical, or measurement techniques, along with their frequency
- Description of control limits for each QC activity and corrective actions when these are exceeded
- Identification of any applicable statistics to be used

Element B6- Instrument/Equipment Testing, Inspection, and Maintenance

- List of equipment and/or systems needing periodic maintenance, testing, or inspection, and the schedule for such
- Description of how inspections and periodic preventive maintenance procedures will be performed and documented
- Discussion on how critical spare parts will be supplied and stocked
- Description of how re-inspections will be performed and effectiveness of corrective actions determined and documented

Element B7- Instrument/Equipment Calibration and Frequency

- List of all project tools, gauges, instruments, and other sampling, measuring, and test equipment which should be calibrated
- Description of calibration method and identification of any certified equipment and/or standards to be used
- Details of how calibration records will be maintained and traceable to the instrument/ equipment

Element B8- Inspection/Acceptance of Supplies and Consumables

- A list of project supplies and consumables that may directly or indirectly affect the quality of the results
- The acceptance criteria for them
- Identification of those responsible

Element B9- Non-direct Measurements

- Identification of any existing data that will be obtained from non-measurement sources, such as literature files and historical databases
- Description of how you intend to use the data
- Your acceptance criteria and any limitations for using such data

Element B10- Data Management

- Description of the project data management process
- Description of or reference to the office's standard record-keeping procedures and document control, data storage, retrieval, and security systems
- Identification of data handling equipment and procedures to process, compile, and analyze project data
- Discussion of data handling procedures to detect and correct errors and loss during data processing
- Examples of any forms or checklists to be used
- Identification of any specific computer hardware/software performance requirements and how configuration acceptability will be determined
- Description of how applicable information resource management requirements will be satisfied, as well as any applicable Agency information resource management requirements (EPA Directive 2100, EPA QA Project Plans only)

GROUP C: ASSESSMENT AND OVERSIGHT

Assessments or evaluations are designed to determine whether the QA Project Plan is being implemented as approved (conformance/nonconformance), to increase confidence in the information obtained, and ultimately to determine whether the information may be used for their intended purpose. The two elements in this group detail what assessments or evaluations will occur both during and after the project. Data assessments, such as data verification and validation, are discussed in the Group D elements.

Element C1- Assessments and Response Actions

- Description of project assessments planned and a brief discussion of the information expected
- Approximate schedule for these assessments and their reports
- For any planned self-assessments, identification of potential participants and their relationship within the project organization
- For independent assessments, identification of the organization and person(s) that will conduct the assessments
- Identification of how, when, and to whom the results of each assessment will be reported and corrective actions implemented

Element C2- Reports to Management

- Frequency and distribution of reports to inform management (EPA or otherwise) of the project's status
- Identification of report preparer and recipients, as well as any specific actions or recommendations recipients are expected to make

GROUP D: DATA VALIDATION AND USABILITY

The three elements in this group address the final project checks to see if the data or product obtained will conform to the project's objectives, and to estimate the effect of any deviations. For projects that use existing data, these elements focus on evaluating how data values from these acquired data sets will be used to determine the quality objectives for the new data use. For a modeling project, this process is similar to confirming that the steps in the modeling process were followed correctly to produce the model outputs and that the results meet project objectives.

Element D1- Data Review, Verification, and Validation

State the criteria for deciding to accept, reject, or qualify project data in an objective and consistent manner

Element D2- Verification and Validation Methods

- Description of how project data will be verified and validated
- Discussion of how any issues will be resolved and identification of who has the authority for resolving them
- Description of how results will be conveyed to data users
- Explanation of how validation issues differ from verification issues for this project
- Examples of any forms or checklists to be used and identification of any project-specific calculations

Element D3- Reconciliation with User Requirements

- Description of how project results will be reconciled with the requirements defined by the data user or decision maker
- An outline of methods proposed to analyze the data and determine possible anomalies or departures from assumptions made when the project was planned
- Description of how reconciliation with user requirements will be documented, issues will be resolved, and how limitations on the use of the data will be reported to decision makers

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-006

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2016

Base Option Period Number 1

Title of Work Assignment/SF Site Name:

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Cost/Fee	LOE
Contract Period: 04/01/2015 To 03/31/2016		4,360
This Action:		0
Total:		4,360

Work Plan / Cost Estimate Approvals

	Cost/Fee	LOE
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Jim Jetter	Branch/Mail Code:
(Signature) (Date)	Phone Number: 919-541-4830
	FAX Number:
Project Officer Name: Robin Baily	Branch/Mail Code:
(Signature) (Date)	Phone Number: 919-541-7906
	FAX Number:
Other Agency Official Name:	Branch/Mail Code:
(Signature) (Date)	Phone Number:
	FAX Number:
Contracting Official Name: Mark Cranley	Branch/Mail Code:
(Signature) (Date)	Phone Number: 513-487-2351
	FAX Number: 513-487-2109

Amendment

Performance Statement of Work

WA Title: Cookstove Emissions and Fuel Efficiency Research

WA #: 1-006 WACOR: Jim Jetter

Contract #: EP-C-15-008

AMENDMENT

This amendment expands the current task by adding needed data analysis for the publication of reports on cookstove emissions and fuel efficiency, including processing of data for Science Hub and for meeting QA data audit requirements. See AMENDMENT under Data Analysis on Page 5.

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017. This work is a continuation of the project started under WA 0-006.

SUMMARY OF OBJECTIVES

The primary objective of this WA (work assignment) is to measure energy efficiency and air pollutant emissions from practical, fuel-efficient, "cleaner-burning" cookstoves. Pollutant emissions from "cleaner-burning" solid-fuel stoves shall be compared to emissions from the traditional "three-stone" fire, as well as to emissions from liquid- and gas-fueled stoves. This study provides stove emissions information that will be valuable to Global Alliance for Clean Cookstoves (the Alliance) partners disseminating stove technology in the field. Additionally, this study is exploring how cookstove performance and emissions are affected by conditions including fuel moisture content, fuel size and shape, operator technique, weather conditions, pot size and shape, and stove durability. Results from this study will support the development of testing protocols and standards through ISO Technical Committee 285, Clean Cookstoves and Clean Cooking Solutions. This work also provides technical support for the development of Regional Testing and Knowledge Centers, many of which are sponsored by the Alliance. Stoves to be tested are identified below.

BACKGROUND

This work is part of EPA's commitment in support of the Global Alliance for Clean Cookstoves. The Alliance was launched after ten years of foundational work conducted by the EPA-led Partnership for Clean Indoor Air (now integrated with the Alliance). The Alliance is a public-private partnership that seeks to save lives, improve livelihoods, empower women, and protect the environment by creating a thriving global market for clean and efficient household cooking solutions. Its ambitious goal is to foster the adoption of clean cookstoves and fuels in 100 million households by 2020. For more information, see the Alliance web site at: http://www.cleancookstoves.org/

The WHO (World Health Organization) estimates that household air pollution mainly from solid-fuel cookstoves causes more than 4 million premature deaths annually – greater than the combined impact of HIV, malaria, and tuberculosis globally. Cookstove emissions of black carbon, brown carbon, organic carbon, CO_2, and methane also affect global climate change.

Reducing household air pollution associated with burning solid fuels provides multiple benefits. Human health is improved through better indoor air quality and ambient air quality. Sustainability and ecology are promoted through reduced deforestation and protection of biodiversity. Global climate change is addressed through reduced emissions of greenhouse gases and other climate forcers. International relations are improved through collaboration with partners.

SCOPE

The scope of this WA includes operation of research facilities, testing of stoves and fuels, gravimetric filter sample analysis, data processing and analysis, and other activities, as described in detail below.

TECHNICAL APPROACH /OBJECTIVES

Operation of research facilities. The contractor shall operate an existing cookstove test facility in the EPA High Bay Building (Room H-106). This system has capabilities for testing stoves with tall chimneys and for measuring emissions at various dilution ratios. The contractor shall operate, maintain, and repair the facilities, as needed. EPA will provide instrumentation. The contractor shall provide continuous improvement of the system, as needed, to meet QA requirements, improve efficiency of operations, and improve general quality.

Testing of stoves and fuels. The EPA WACOR will obtain the stoves and will specify which stoves will be tested. The Contractor shall operate the stoves during the testing. This work is a continuation of the project started under WA 0-006, and stoves to be tested will include the following types:

- Gasifier-type, rocket-type, and charcoal-fuel-type stoves identified for round-robin testing in coordination with the Global Alliance for Clean Cookstoves, Regional Testing and Knowledge Centers
- Three advanced technologies developed through the U.S. Department of Energy's cookstove research program
- Two stoves to be identified in a joint U.S. – China Ministry of Science and Technology (MOST) project. The two stoves shall be tested with the WBT (Water Boiling Test) Version 4.2.3 (described below) as well as the China test protocol: http://cleancookstoves.org/technology-and-fuels/testing/protocols.html
- Stoves to be tested experimentally to support development of international protocols and standards through ISO Technical Committee 285 – Clean Cookstoves and Clean Cooking Solutions
- Additional test replications required for meeting QA requirements for stoves previously tested.
- LPG (liquified petroleum gas) stoves operated under various conditions and with various blends of propane and butane.

Total number of stove/fuel combinations to be tested: 40 total with completion of 2 per month.

Fuels to be tested. Wood-burning stoves shall be tested with high- and low-moisture hardwood, red oak, fuel. Freshly cut "green" red oak firewood without bark, lengths approximately 14", will be obtained from a local vendor. The wood shall be cut on a table saw and/or band saw to produce sticks that shall be approximately 2 cm x 2 cm in cross section. Half of the fuel wood shall be air dried to a moisture content of approximately 10 percent (on a wet basis), and the other half of the fuel wood shall be stored in air-tight barrels in a freezer to keep the moisture content at approximately 30 percent.

The charcoal stoves shall be tested with "lump" charcoal (not compressed briquettes) similar to that available in developing countries. Stoves shall be tested with "dry" charcoal (approximately 5 percent moisture content on a wet basis). Charcoal stoves shall be tested following guidelines available from the Global Alliance for Clean Cookstoves web site:
http://cleancookstoves.org/binary-data/DOCUMENT/file/000/000/401-1.pdf

All fuels shall be analyzed for moisture content using ASTM Standard Method D4442-07. Moisture content of the fuels shall be measured on each day of testing. A random sample of fuel wood, with a mass of approximately 100 g, shall be weighed with an electronic balance. The sample shall be dried in a ventilated oven for at least 8 hours, and then the sample shall be weighed periodically until no mass change is detected. The percent moisture content in the wood on a percent wet basis shall be calculated and recorded.

All fuels shall be analyzed for heat of combustion using ASTM Standard Method ASTM D5865-04. This testing shall be done by a qualified outside laboratory.

Air pollutants to be measured. The contractor shall measure emissions of the following pollutants for each stove and fuel combination:

- CO2 - real-time, CEM (IR)
- CO - real-time, CEM (IR)
- PM2.5, measured gravimetrically, filter sample taken during each of the three phases of the WBT (Water Boiling Test – see below)
- BC (black carbon) – real-time with aethalometer
- EC (elemental carbon) and OC (organic carbon) – quartz filter sample taken during each of the three phases of the WBT and analyzed with the thermal-optical method. Quartz "back-up" filter sample also taken during each WBT phase to quantify the gas-phase artifact
- PM, submicrometer particles measured with SMPS (scanning mobility particle sizer)
- THC (total hydrocarbon) - real time, FID total HC analyzer
- CH4 (methane) - real time, FID analyzer
- Other pollutants may be added if resources (instruments and personnel) are available

The EPA will furnish instrumentation and equipment necessary to measure air pollutants.

BC/EC/OC analysis will be provided by EPA Emissions Characterization and Prevention Branch, contact: Michael Hays

Test protocol. WBT (Water Boiling Test) Version 4.2.3 available at: http://cleancookstoves.org/technology-and-fuels/testing/protocols.html

A summary of the performance test protocol follows:

"This modified version of the well-known Water Boiling Test (WBT) is a simulation of the cooking process that can be performed on most stoves in use throughout the world. While the test is not intended to replace other forms of stove assessment, it is designed to be a simple method by which stoves made in different places and for different cooking applications may be compared by a standardized and replicable protocol."

"The WBT ...consists of three phases.

1) In the first phase, the tester begins with the stove at room temperature and uses a pre-weighed bundle of wood to boil a measured quantity of water in a standard pot. The tester then replaces the boiled water with a fresh pot of cold water to perform the second phase of the test.

2) In the second phase, water is boiled beginning with a hot stove in order to identify differences in performance between a stove when it is cold and when it is hot.

3) Lastly, the tester again boils a measured amount of water and then, using a pre-weighed bundle of wood, simmers the water at just below boiling for a measured period of time (45 minutes). The third step simulates the long cooking of legumes or pulses that is common throughout much of the world."

"This combination of tests is intended to measure the stove's performance at both high and low power outputs, which are important indicators of the stove's ability to conserve fuel."

Gravimetric filter sample analysis. The contractor shall perform gravimetric filter analysis for $PM_{2.5}$ using EPA facilities in Room E-487. The contractor shall perform manual or robotic weighing of the filters.

Data analysis. The contractor shall provide support for processing and analyzing data from the cookstove tests conducted under this WA. The contractor shall work closely with the EPA WACOR. The contractor shall use DASYLab software for data acquisition and Microsoft Excel spreadsheets for processing data. Microsoft Access may be used in the future for managing data. The contractor-provided support shall include QA checks of manual data entry, importing raw data into "daily data" spreadsheets, importing processed data from "daily data" spreadsheets into "stove/fuel spreadsheets," evaluating carbon balance calculations, and final QA checks. The contractor shall identify tests that do not meet QA requirements, and repeat tests if necessary. This work will be described in a QAPP (Quality Assurance Project Plan) and associated MOPs (see below). The work will be coordinated with the EPA WACOR, and the EPA WACOR will provide further details.

The contractor shall use the automated system that has been developed to enable immediate data processing following each stove test (not including analysis of samples that require post-processing, e.g., filter samples).

AMENDMENT: The contractor shall provide additional support for data analysis for the preparation of reports on cookstove emissions and fuel efficiency, including processing of data for Science Hub and for meeting QA data audit requirements. Specifically, the contractor shall analyze data in "stove/fuel spreadsheets," prepare data for inclusion in stove/fuel reports, perform QA checks on data, prepare data for Science Hub, and address requirements from QA reviews of reports and audits of data quality.

Results. The contractor shall deliver data to the EPA WACOR in Microsoft Excel files that can be easily analyzed. Results shall be reported as averages and standard deviations for the three tests for each stove. The contractor shall report data including all parameters in the WBT test protocol, and the data shall be in format similar to that used in previous testing.

SAFETY

The Contractor shall comply with a Health and Safety Protocol. The Contractor shall maintain a safe working environment during testing.

QUALITY ASSURANCE

A new QAPP (Level II) will be prepared and submitted for approval, and a QAPP for a similar previous work will be provided by the WACOR to aid in the development of the new QAPP. Internal technical systems audits have previously been completed, and the project was approved by an EPA internal quality assurance review. An internal audit of data quality was also previously performed, and a second audit is in progress. If any revision of the QAPP (and associated MOPs) is required, the QAPP shall be reviewed and approved by the JTI work assignment leader and QA officer. Once it has obtained their approval, it shall be submitted to the EPA QA staff for review and approval. It shall be accompanied by a signature page that is signed by the JTI work assignment leader and QA officer to show that they have reviewed and approved the revised QAPP. It is the responsibility of the JTI work assignment leader to document this process. Upon receipt of the signed QAPP, the EPA work assignment manager and QA manager will review and approve the QAPP and they will add their signatures to the signature page. Any work involving environmental data shall not commence until the QAPP has received official approval from the EPA QA staff.

See: ATTACHMENT #1 TO STATEMENT OF WORK FOR QA CATEGORY II PROJECTS.

DELIVERABLES

The Contractor shall prepare and deliver brief, monthly progress reports in accordance with the reporting requirements in the contract. The contractor shall deliver data and filter samples to the EPA WACOR. The final report will be prepared by the EPA WACOR and will be in the form of EPA reports and a manuscript to be submitted to a peer-reviewed journal for publication. Contractor personnel may be coauthors of the publications.

SCHEDULE of DELIVERABLES

Raw test data, filter samples, and processed data shall be deliverables.

Schedule is as follows:

January 31, 2017 Complete cookstove testing

February 28, 2017 Deliver all filter samples and raw test data

March 31, 2017	Complete data analysis and quality assurance, and deliver all processed data

ATTACHMENT #1 TO STATEMENT OF WORK FOR QA CATEGORY II PROJECTS

NRMRL QA Requirements and Definitions

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation described herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The QAPP shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government.

Definitions:

Environmental Data - These are any measurements or information that describe environmental processes, location, or conditions; ecological or health effects and consequences; or the performance of environmental technology. For EPA, environmental data include information collected directly from measurements, produced from software and models, and compiled from other sources such as data bases or the literature.

Quality Assurance (QA) - Quality assurance is a system of management activities to ensure that a process, item, or service is of the type and quality needed by the customer. It deals with setting policy and running an administrative system of management controls that cover planning, implementation, and review of data collection activities and the use of data in decision making. Quality assurance is just one part of a quality system.

Quality Assurance Project Plan (QAPP) - A QAPP is a document that describes the necessary quality assurance, quality control, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. A QAPP documents project-specific information.

Quality Control (QC) - Quality control is a technical function that includes all the scientific precautions, such as calibrations and duplications, that are needed to acquire data of known and adequate quality.

Quality Management Plan (QMP) - A QMP is a document that describes an organization's/program's quality system in terms of the organizational structure, policy and procedures, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, documenting, and assessing all activities conducted. A QMP documents the overall organization/program, and is primarily applicable to multi-year, multi-project efforts. An organization's/program's QMP shall address all elements listed in the "Requirements for Quality Management Plans" in Appendix B of the NRMRL QMP.

Quality System - A quality system is the means by which an organization manages its quality aspects in a systematic, organized manner and provides a framework for planning, implementing, and assessing work performed by an organization and for carrying out required quality assurance and quality control activities.

R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001
http://www.epa.gov/quality/qs-docs/r5-final.pdf

Substantive Change - Substantive change is any change in an activity that may alter the quality of data being used, generated, or gathered.

EPA's Quality System Website: http://www.epa.gov/quality/

EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function;
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

Category Level Designations (determines the level of QA required):

□ **Category I Project** - applicable to studies performed to generate data used for enforcement activities, litigation, or research project involving human subjects. The QAPP shall address all elements listed in R-5.

X **Category II Project** - applicable to studies performed to generate data used in support of the development of environmental regulations or standards. The QAPP shall address all elements listed in R-5.

□ **Category III Project** - applicable to projects involving applied research or technology evaluations. The QAPP shall address the applicable sections of R-5, as outlined in the NRMRL QAPP requirements for the specific project type.

□ **Category IV Project** - applicable to projects involving basic research or preliminary data gathering activities. The QAPP shall address the applicable sections of R-5, as outlined in the NRMRL QAPP requirements for the specific project type.

Suggested Content for Required Elements of QA Project Plans as per R-5:

GROUP A PROJECT MANAGEMENT

There are nine elements in this group. These address project administrative functions and project concerns, goal(s), and approach(es) to be followed.

Element A1- Title and Approval Sheet

- Project title
- Organization name
- Names, titles, signatures, and signature dates of the approving officials

Element A2- Table of Contents

- Table of Contents;
- List of Figures, Tables, References and Appendices
- Document control format

Element A3- Distribution List

Names of individuals and organization(s) to receive a copy of the approved QA Project Plan

Element A4- Project/Task Organization

- List of individuals and organizations involved with the project, identifying their roles and responsibilities
- Documentation of project QA Manager's independence
- Identification of the individual responsible for maintaining the official, approved QA Project Plan
- Organizational chart showing relationships and lines of communication among project personnel

Element A5- Problem Definition/Background

- Statement of specific problem to be solved, decision to be made, or outcome to be achieved
- Background information

Element A6- Project/Task Description

- Summary of work to be performed and products
- Project schedule
- Maps, tables, etc. showing geographic locations

Element A7- Quality Objectives and Criteria

- Outputs from the systematic planning process (e.g., DQOs) used to design the study
- Measurement performance or acceptance criteria established as part of the study design. These relate the quality of data needed to the established limits on the chance of making a decision error or of incorrectly answering a study question

Element A8- Special Training/Certifications

- Description of how the most current approved QA Project Plan will be distributed to project staff
- List of records to be included in the data report package
- List of any other project documents to be produced
- Information on the final disposition of records and documents, including location and retention schedule

Element A9- Documentation and Records

- Any specialized training or certifications needed by personnel
- Plans for providing, documenting, and assuring this training

GROUP B: DATA GENERATION AND ACQUISITION

The ten elements in this group address data generation and data acquisition and management activities.

Element B1- Sampling Process Design (Experimental Design)

Description of project's experimental design

Element B2- Sampling Methods

- Description of sample/data collection procedures
- List of equipment needed
- Identification of performance requirements
- Description of corrective actions to be taken if problems arise

Element B3- Sample Handling and Custody

Description of sample handling requirements and transfer, and for ultimate disposal

Element B4- Analytical Methods

- Description of analytical methods to be used
- Identification of any performance criteria
- Description of corrective actions when problems arise

Element B5- Quality Control

- List of QC activities needed for sampling, analytical, or measurement techniques, along with their frequency
- Description of control limits for each QC activity and corrective actions when these are exceeded
- Identification of any applicable statistics to be used

Element B6- Instrument/Equipment Testing, Inspection, and Maintenance

- List of equipment and/or systems needing periodic maintenance, testing, or inspection, and the schedule for such
- Description of how inspections and periodic preventive maintenance procedures will be performed and documented
- Discussion on how critical spare parts will be supplied and stocked
- Description of how re-inspections will be performed and effectiveness of corrective actions determined and documented

Element B7- Instrument/Equipment Calibration and Frequency

- List of all project tools, gauges, instruments, and other sampling, measuring, and test equipment which should be calibrated
- Description of calibration method and identification of any certified equipment and/or standards to be used
- Details of how calibration records will be maintained and traceable to the instrument/ equipment

Element B8- Inspection/Acceptance of Supplies and Consumables

- A list of project supplies and consumables that may directly or indirectly affect the quality of the results
- The acceptance criteria for them
- Identification of those responsible

Element B9- Non-direct Measurements

- Identification of any existing data that will be obtained from non-measurement sources, such as literature files and historical databases
- Description of how you intend to use the data
- Your acceptance criteria and any limitations for using such data

Element B10- Data Management

- Description of the project data management process
- Description of or reference to the office's standard record-keeping procedures and document control, data storage, retrieval, and security systems
- Identification of data handling equipment and procedures to process, compile, and analyze project data
- Discussion of data handling procedures to detect and correct errors and loss during data processing
- Examples of any forms or checklists to be used
- Identification of any specific computer hardware/software performance requirements and how configuration acceptability will be determined
- Description of how applicable information resource management requirements will be satisfied, as well as any applicable Agency information resource management requirements (EPA Directive 2100, EPA QA Project Plans only)

GROUP C: ASSESSMENT AND OVERSIGHT

Assessments or evaluations are designed to determine whether the QA Project Plan is being implemented as approved (conformance/nonconformance), to increase confidence in the information obtained, and ultimately to determine whether the information may be used for their intended purpose. The two elements in this group detail what assessments or evaluations will occur both during and after the project. Data assessments, such as data verification and validation, are discussed in the Group D elements.

Element C1- Assessments and Response Actions

- Description of project assessments planned and a brief discussion of the information expected
- Approximate schedule for these assessments and their reports
- For any planned self-assessments, identification of potential participants and their relationship within the project organization
- For independent assessments, identification of the organization and person(s) that will conduct the assessments
- Identification of how, when, and to whom the results of each assessment will be reported and corrective actions implemented

Element C2- Reports to Management

- Frequency and distribution of reports to inform management (EPA or otherwise) of the project's status
- Identification of report preparer and recipients, as well as any specific actions or recommendations recipients are expected to make

GROUP D: DATA VALIDATION AND USABILITY

The three elements in this group address the final project checks to see if the data or product obtained will conform to the project's objectives, and to estimate the effect of any deviations. For projects that use existing data, these elements focus on evaluating how data values from these acquired data sets will be used to determine the quality objectives for the new data use. For a modeling project, this process is similar to confirming that the steps in the modeling process were followed correctly to produce the model outputs and that the results meet project objectives.

Element D1- Data Review, Verification, and Validation

State the criteria for deciding to accept, reject, or qualify project data in an objective and consistent manner

Element D2- Verification and Validation Methods

- Description of how project data will be verified and validated
- Discussion of how any issues will be resolved and identification of who has the authority for resolving them
- Description of how results will be conveyed to data users
- Explanation of how validation issues differ from verification issues for this project
- Examples of any forms or checklists to be used and identification of any project-specific calculations

Element D3- Reconciliation with User Requirements

- Description of how project results will be reconciled with the requirements defined by the data user or decision maker
- An outline of methods proposed to analyze the data and determine possible anomalies or departures from assumptions made when the project was planned
- Description of how reconciliation with user requirements will be documented, issues will be resolved, and how limitations on the use of the data will be reported to decision makers

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-007

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance

From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Susan Thorneloe
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-2709
FAX Number:

Project Officer Name Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Work Statement

WA Title: ***Characterizing cross-media transfers from landfills, and management of coal ash and other industrial by-products***

WA #: 1-007 WACOR: S. Thorneloe

Contract #: EP-C-15-008 Alternate WACOR: R. Shores

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

BACKGROUND

This work assignment will build on previous research to improve the understanding of cross media transfers related to management of landfills, coal ash, and other industrial by-products. This research supports program office needs to provide the technical basis for evaluating emissions to the environment that can cross air, water, and land.

The Leaching Environmental Assessment Framework (LEAF) includes leaching methods, data management, analysis, and visualization, and a How to Guide for LEAF implementation for how Hg and other inorganics in fly ash and other industrial by-products may re-enter the environment based on how the material is managed through disposal or use in engineering and commercial applications. This work assignment supports EPA program offices and Regions to complete work aimed at implementation of LEAF for evaluating Hg and other inorganics. The methods have been completed and are released as new methods on EPA's SW-846 website. The How to Guide for LEAF implementation is in final review. In WA 007, work was to be completed updating LeachXS-Lite to reflect the different material-specific datasets along with LEAF data. This spring or summer the program office will announce the availability of the methods, software and guidance.

Until we get further guidance on what additional effort may be needed for leaching methods for inorganics, work is to begin assessing what would be needed to address leaching of inorganics. Similar to a document developed in the previous on-site contract, a background information document will be developed specific to organics. A major basis for this document will be the findings of the report of the workshop to evaluate issues unique to organics when assessing their release in the environment. As was done with LEAF for inorganics, the focus is on developing a source term for release. Fate and transport modeling is not part of the work to be done.

Work began this past couple of months to complete landfill research is from reduce current uncertainties to estimate landfill gas emissions by quantifying all biodegradable components in municipal solid waste from sorting waste from several different municipalities. In the previous work assignment under the former on-site contract, samples were collected and analyzed to prepare a report. The Contractor will have a draft of the final report provided by the end of the current performance period (March 31, 2016).

Provided below is a list of tasks for FY2016 for the research to be conducted through this work assignment.

SCOPE

1. ***Development/Modification/Compliance with QAPP***: The contractor shall develop quality assurance documentation as required in Appendices #1, 2, and 3 to this Statement of Work. Any work involving environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff. The contractor shall comply with all requirements as delineated on the "Quality Assurance Review Form" included with this extramural activity.

   There is an existing QAPP for this research (Q-TRAK # 03069-A00244) which will should help prepare new QAPPs appropriate for this work. Updates as needed will be prepared along with identifying all key personnel. There is also an approved QAPP for the CRADA funded project (Q-TRAK# 13029/A 19326). This QAPP was approved on Dec 9, 2013 and will also need to be updated.

2. ***Completion of Leach-XS Lite.*** The Contractor has made improvements to LeachXS-Lite based on comments from the EPAWA-COR including adding additional material datasets and available LEAF data. For the new WA, based on comments from users of the tool, we may be updating the input templates, adding embedded tutorials, and screening assessment scenarios that provide a source term for use in OSWER's Industrial Waste Management Evaluation Model (IWEM) [http://www.epa.gov/osw/nonhaz/industrial/tools/iwem/] or other ground water transport and fate models. The Contractor shall make changes to IWEM as needed based on EPA review of the software meeting the requirements for EPA software products.

3. ***Completion of methane potential research***. The Contractor shall make changes to the draft report on the methane potential resulting from EPA review through peer, QA, and administrative review.

4. ***Evaluating effect of Calcium Bromide on leaching of inorganics.*** A paper is under development to document the results from analyzing a fly ash that resulted from burning coal at a plant where calcium bromide was used. The results in the manuscript need to be document the results from CVAA analysis, XRF and LEAF test methods.

5. ***Background Information Document on Leaching of Organics.*** Using the report from the workshop on leaching of organics, the contractor shall prepare a report similar to the document

prepared for inorganics. This document will summarize what is known currently about leaching of semi- and non-volatiles organics using information from the September 2015 workshop. The document will also identify bench scale work to narrow down the drivers for leaching that change based on the environmental conditions where waste or material is managed (e.g., liquid to solid ratio, pH, precipitation rate, and hydrology). The first output will be a draft outline and a schedule for completing the document within this performance period and budget.

Schedule of Deliverables

Task 1 -	New or updated QAPPS as needed
Task 2 –	Within performance period
Task 3 –	Within 6 months of award
Task 4 -	Within 6 months of award
Task 5 -	Within performance period

ATTACHMENT #1 TO THE STATEMENT OF WORK (SOW)

FOR SECONDARY DATA PROJECTS

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,

http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function; 07/14/08 A-2

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,

http://www.epa.gov/quality/qs-docs/r2-final.pdf

□ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001
http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

□ **QAPP Requirements for Measurement Projects**

X **QAPP Requirements for Secondary Data Projects**

□ **QAPP Requirements for Research Model Development and/or Application Projects**

□ **QAPP Requirements for Software Development Projects**

□ **QAPP Requirements for Method Development Projects**

□ **QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/

EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

---

NRMRL QAPP REQUIREMENTS FOR SECONDARY DATA PROJECTS

GENERAL REQUIREMENTS

Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.

1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.

2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Identify the secondary data needed to meet the project objective(s). Specify requirements relating to the type of data, the age of data, geographical representation, temporal representation, and technological representation, as applicable.

3.2 Identify the source(s) for the secondary data. Discuss the rationale for selecting the source(s) identified. If a hierarchy of sources exists for the gathering of secondary data, specify that hierarchy.

4. QUALITY METRICS

4.1 Specify the quality requirements of the secondary data. These requirements must be appropriate for the intended use of the data. Address accuracy, precision, representativeness, completeness, and comparability, if applicable.

4.2 Describe the procedures for determining the quality of the secondary data.

4.3 If no project-specific data quality requirements exist, state this in the QAPP. If the quality of the secondary data will not be evaluated by EPA, require that a disclaimer be added to any project deliverable to indicate that the quality of the secondary data has not been evaluated by EPA for this

specific application. Provide the wording for the disclaimer.

5. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

5.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

5.2 Describe data validation procedures used to ensure the reporting of accurate project data.

5.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).

5.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

5.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

5.4 Describe data storage requirements for both hard copy and electronic data.

6. REPORTING

6.1 List and describe the deliverables expected from each project participant.

6.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report, etc.). Specify the source(s) of the secondary data in any deliverable.

7. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

ATTACHMENT #2 TO THE STATEMENT OF WORK (SOW)

FOR SOFTWARE DEVELOPMENT PROJECTS

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,

http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function; 07/14/08 A-2

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,

http://www.epa.gov/quality/qs-docs/r2-final.pdf

□ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001
http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

□ **QAPP Requirements for Measurement Projects**

□ **QAPP Requirements for Secondary Data Projects**

□ **QAPP Requirements for Research Model Development and/or Application Projects**

X **QAPP Requirements for Software Development Projects**

□ **QAPP Requirements for Method Development Projects**

□ **QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/

EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

---

NRMRL QAPP REQUIREMENTS FOR SOFTWARE DEVELOPMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the software and its intended application.

1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.

2.2 Include a project schedule that includes key milestones.

3. FUNCTIONAL REQUIREMENTS

3.1 Provide a list of the most important functions that the software system must address.

3.2 Identify requirements for functionality, external interfaces (includes graphical user interfaces and interfaces which are needed for other programs to call subroutines from the software, as applicable), performance, and design constraints. Each requirement should be uniquely identified and defined such that its achievement is capable of being objectively verified and validated.

3.3 Specify computer hardware and operating system requirements.

4. SYSTEM DESIGN

4.1 Provide an overview of the system design (e.g., block diagrams showing relationships between major program modules, hardware devices, and data input/output).

4.2 Describe the components and subcomponents of the software design, including databases and internal interfaces. The description should link the software structure to the functional requirements.

4.3 Provide the rationale for selecting the proposed hardware and software tools

5. IMPLEMENTATION

5.1 Describe how a working software system is developed from the design specifications.

5.2 Describe how the requirements for functionality, external interfaces, performance, and design constraints will be verified and validated.

5.3 Describe how release and delivery of the product is managed, including versions for alpha and beta testing.

5.4 Describe the procedures for controlling, documenting, and archiving all significant changes to software and hardware.

5.5 Identify the archiving software used for controlling, documenting, saving, and recovering changes made to the source code.

6. VALIDATION, VERIFICATION, AND TESTING

6.1 Describe the testing strategy that will be used along with the procedures for each planned test. Testing may include individual module tests, integration tests, system testing, acceptance testing, and alpha and beta testing.

6.2 Describe the procedure for checking the correctness of outputs.

6.3 Describe how it will be determined if the developed software product conforms to requirements, and whether the software product fulfills the intended use and user expectations. This includes analysis, evaluation, review, inspection, assessment, and testing of the software product and the processes that produced the product.

7. DOCUMENTATION, MAINTENANCE, AND USER SUPPORT

7.1 Specify the requirements for project documentation (e.g., requirements and design document, configuration maintenance plan, operations manual, source code, user's guide).

7.2 Describe the procedures for maintenance and user support when software or data generated by the project will be distributed outside NRMRL.

7.3 Define the methods and facilities used to maintain, store, secure, and document controlled versions and related artifacts of the identified software during all phases of the software life cycle.

8. REPORTING

8.1 List and describe the deliverables expected from each project participant.

8.2 Specify the expected final product(s) that will be prepared for the project (e.g., software, user documentation, user interface).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

ATTACHMENT #3 TO THE STATEMENT OF WORK (SOW)

FOR MEASUREMENT PROJECTS

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,

http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function; 07/14/08 A-2

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,

http://www.epa.gov/quality/qs-docs/r2-final.pdf

□ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X **QAPP Requirements for Measurement Projects**

□ **QAPP Requirements for Secondary Data Projects**

□ **QAPP Requirements for Research Model Development and/or Application Projects**

□ **QAPP Requirements for Software Development Projects**

□ **QAPP Requirements for Method Development Projects**

□ **QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/

EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

---

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

2. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.

1.2 State the purpose of the project and list specific project objective(s).

3. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.

2.2 Include a project schedule that includes key milestones.

4. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and

numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.

3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.

3.3 Describe the general approach and the test conditions for each experimental phase.

5. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.

4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.

4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.

4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.

4.5 Describe the method for uniquely numbering each sample.

4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5 MEASUREMENT PROCEDURES

5.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.

5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6 QUALITY METRICS (QA/QC CHECKS)

6.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

6.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7 DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

7.2 Describe data validation procedures used to ensure the reporting of accurate project data.

7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).

7.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

7.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

7.4 Describe data storage requirements for both hard copy and electronic data.

8 REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-008

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Chun-Wai Lee	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-7663
			FAX Number:
Project Officer Name Robin Baily	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-7906
			FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code:
			Phone Number:
			FAX Number:
Contracting Official Name Mark Cranley	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-487-2351
			FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Environmental Implication of Advanced Combustion Technologies

WA #:1-008 WACOR: C. W. Lee

Contract #: EP-C-15-008 Alternate WACOR: Bill Linak

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (PSOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

The primary objective of this project is to investigate the transformation of air pollutants under simulated oxy-coal and oxy-natural gas firing conditions. The effects of this unique combustion environment on the performance of existing air pollution control devices such as fabric filter (FF) and electrostatic precipitator (ESP), wet scrubber, and selective catalytic reduction (SCR), will be evaluated. The potential of the compression and purification (CPU) technology to remove pollutants produced under oxy-coal and oxy-natural gas combustion conditions will also be assessed.

BACKGROUND

Oxygen enrich coal (oxy-coal) combustion as applied to utility coal boilers has been considered one of the promising advanced technologies for mitigating global climate change caused by emissions of CO_2 from coal-fired power plants. This emerging advanced combustion technology currently under development essentially involves process modifications to remove ~80% of volumetric input flow (nitrogen) so as to produce a concentrated CO_2/H_2O exhaust amenable to further processing, compression, and sequestration. There is very little information on how pollutant species such as sulfur, fuel nitrogen, ash, metals, Hg, potential organic hazardous air pollutants (HAPs), etc. will behave and be transformed under the unique conditions of oxy-coal combustion and also the effects of this unique environment on the performance of existing pollution control devices. These transforming pollutant species are likely to affect the operation of different boiler and pollution control systems in both adverse and perhaps beneficial ways. Further, emissions that would normally escape controls and be released as air emissions (O_2, SO_2, SO_3, NO, NO_2, ultrafine ash and metals, Hg, Se, and organic HAPs) now may be compressed and sequestered with the CO_2 and affect its chemistry during transport and in geological storage. In this project, the effect of oxy-coal combustion on the formation and behavior of these pollutants and the effect of this environment on the performance of existing pollution control devices will be investigated.

There is also a significant lack of understanding regarding the environmental issues associated with the CO_2 compression process following the oxy-combustion. Key questions include: (1) what flue gas components, compositions, and concentrations can be processed by compression and purification units (CPUs) and what additional pretreatment is required; (2) how do flue gas species partition to the various CPU effluents; (3) how do process changes on the combustion side that affect CPU operation and partitioning; (4) what purity of CO_2 produced from the CPU is required to ensure safe, very long-term, geologic sequestration; and (5) is it possible for trace levels of impurities (such as oxygen, nitrogen, argon, acids, particles, metals, CO, organics, etc.) to be compressed and sequestered with the CO_2? Air Liquide, a leading industrial gas provider, has developed a compression and purification technology concept to capture, compress, and purify CO_2 generated from the oxy-coal combustion process for sequestration purposes. The process is designed to process the CO_2-enriched flue gas generated from the oxy-coal combustion process through compressing and condensing CO_2 to separate it from other condensable and non-condensable flue gas components for pipeline transportation and geologic sequestration. The multi-stage compression and purification unit (CPU) process can also separate pollutants and impurities from the flue gas. In contrast to existing conventional coal-fired power plants, this process has the potential to produce near zero emissions of air pollutants. APPCD and Air Liquide are collaborating on their experimental research efforts for evaluating the potential of CPU technologies to reduce pollutants from oxy-coal combustion under a Cooperative Research and Development Agreement (CRADA) with EPA. The objectives of research are: to examine different flue gas conditioning and CPU configurations options, and how these affect partitioning, emissions, and potential CO_2 purity and; to validate the efficiency of various CPU process parameters to partition and remove pollutant species (SOx, NOx, Hg, PM, H_2O, CO, organic VOCs, etc.).

SCOPE

TASK 1. Work Plan, Reporting, Budget, And WA Management

The contractor shall prepare and deliver to the WA manager (WAM) a work plan and budget within 20 days of WA effective date. The work plan shall include a description of how the contractor shall accomplish each task, along with a breakdown, per task, level of effort by professional level, a cost breakdown, and any underlying assumptions used. The contractor shall conduct activities necessary to manage the WA, including at least weekly communication with the EPA WAM. When responding to this WA, the contractor shall assume the responsibility to operate APPCD's Innovative Furnace Reactor (IFR). The contractor shall update the existing Quality Assurance Project Plan (QAPP) under the direction of the WAM as specified in Attachment #1. Work involving environmental data shall not commence until the QAPP has received official approval from the EPA Quality Assurance Staff. The contractor shall comply with all requirements as delineated on Attachment #1 to the SOW.

TASK 2 Drop Tube Furnace Experiments

Experimental studies shall collect and analyze gas and particle emissions as a function of oxy-coal operating parameters (O_2, CO_2, H_2O, and temperature). The drop tube furnace shall be operated according to design specifications and establish operating conditions for producing coal combustion aerosol. The furnace has been designed for characterization of the physical and chemical characteristics of drop tube furnace emissions during combustion of pulverized coal. This characterization shall provide data that shall be used to set operating parameters, such as fuel and oxygen feed rates and corresponding exhaust gas characteristics. Quantities to be measured include air and coal feed rates, outlet gas temperature, particle size distribution, and mass emission rates, particle compositions, O_2, CO, NO_x, SO_2, H_2O, and CO_2 gas concentrations. The contractor shall provide support and expertise for sampling and characterization of inorganic and carbonaceous particulate matter emissions.

TASK 3. IFR Experiments

Operation of the IFR

An existing QAPP shall be updated by the contractor for this particular Task. The contractor shall not begin data collection until the QAPP is approved by EPA Quality Assurance Staff. The contractor shall assist in the operation of the IFR. This shall include but not be limited to: natural gas, pulverizing coal, operating the IFR under air- and oxygen-firing modes including the associated air pollution equipment, removing ash and scrubber residue from the facility, and operation of the flue gas sampling system.

Flue Gas Sampling and Analysis

The contractor shall provide support and expertise in vapor-phase sampling for flue gas. This shall include, but not be limited to CO_2, CO, O_2, SO_2, NO_x and total hydrocarbon (THC) measurements taken with continuous emission monitors (CEMs). The contractor shall also provide support and expertise on sampling and characterization of other pollutants which shall be included but not limited to fly ash and metals, Hg, Se, As, and organic hazardous air pollutants (HAPs).

Effect of oxygen enriched combustion on PM emissions and VOC emissions

The contractor shall operate the IFR under oxy-coal firing mode for evaluating the effect of oxy-coal firing on the control of particulate matter (PM). A new electrostatic precipitator (ESP) has been installed recently to the IFR for removing PM from the flue gas in order for recycling most of the flue gas back to the IFR furnace. Flue gas recyling is essential in all oxy-combustion processes. The objective of this subtask is to evaluate the PM control efficiency of the ESP operated under different voltages and current conditions during oxy-coal combustion. The efficient control of PM is very important for the safe operation of the oxy-coal combustion process. The contractor shall provide support and expertise for sampling PM simultaneously at both the inlet and outlet of the ESP using modified EPA Method 5. The contractor shall also provide support and expertise for the characterization of the PM passing through the inlet and outlet location of the ESP using on-line PM measurement instruments including scanning mobility particle

analyzer/aerodynamic particle sizer (SMPS/APS) and the laser-based total PM analyzer made by SICK. The combustion conditions of all the PM control tests will be well characterized. This shall include, but not be limited to CO_2, CO, O_2, SO_2, and NO_x measurements taken with the continuous emission monitors (CEMs). The contractor shall also provide support and expertise on measurements of other specialty gases that are possibly presented in oxy-coal combustion such as N_2O and N_2.

The contractor shall operate the IFR under both oxy-natural gas and oxy-coal firing modes for evaluating the effect of oxygen enriched combustion on emissions of volatile organic compounds (VOCs). The objective of this sub-task is to characterize VOC emissions from both oxy-natural gas combustion and oxy-coal combustion under different IFR furnace operating conditions. The contractor shall provide support and expertise for sampling VOC emissions using the SUMMA canisters. The VOCs samples contained in the canisters will be analyzed using gas chromatography coupled with mass spectrometry (GC/MS) by the existing organic lab set up in the Emissions Characterization & Prevention Branch (ECPB) for measuring VOC emissions from different combustion sources. The contractor shall also provide support and expertise on sampling and characterization of other pollutants such as organic HAPs.

Purchasing of Expendable Supplies

The contractor shall be responsible for purchasing general expendable supplies required to maintain operation of the IFR including the CPU. The WAM shall provide approval for any purchases related to the supplies listed below.

These supplies shall include, but not be limited to:

a) Calibration, supply and carrier gases for analytical systems

b) Valves, tubing and piping

c) Compression fittings

d) Coal and transportation of the coal to EPA's RTP, NC facility

e) Chemicals and reagents including hydrated lime for the wet scrubber

f) Sorbent tubes and other gas-sampling consumables

TASK 4. CPU Installation and Testing

The contractor shall provide technical support to APPCD in the collaborative CPU research with Air Liquide. This support shall include the construction and installation of a laboratory scale CO_2 CPU unit compatible with the IFR combustion research facility that will be used for conducting experiments to evaluate pollutant and purification process effects in oxy-coal combustion systems. Detailed designs for the CPU are being provided by Air Liquide as part of a CRADA with EPA. EPA will provide the large capital components and as many of the small components

(valves, fittings, mass flow controllers, meters, etc.) as practical. The contractor shall coordinate through the WACOR with Air Liquide for addressing technical issues associated with the compatibility of the CPU design and the IFR facility. The contractor shall provide technical support to APPCD to assemble and install the laboratory scale CO_2 CPU and integrate the CPU with the IFR and its SCADA control system. The contractor shall assemble individual components and integrate the CPU within the IFR combustor and its SCADA control system following the design provided by Air Liquide. Many components will be provided by EPA, there are many small components that will need to be customized and constructed on-site.

The contractor shall maintain strict control of all Confidential Business Information (CBI) provided by Air Liquide through the WAM for this task as it is required by Contract (EP-C-15-008) on handling of CBI by the contractor.

Task5. Maintenance and Repair of Facility

The contractor shall modify, maintain, operate, and make improvements to the existing drop tube furnace and the IFR facility, and provide all necessary hardware. The two facilities shall also include any instrumentation required to maintain safe and continuous operating conditions. The contractor shall provide the labor necessary to maintain and repair the IFR including the CPU with associated air pollution equipment such as ESP and other auxiliary equipment. Examples include repairing glassware, calibrating nozzles, pitot tubes, dry gas meters (DGMs), tracking equipment inventories, etc. Conduct of specific actions will be approved in writing by the WACOR prior to initiation of any identified support action. All costs (labor and ODC) incurred from this task shall be tracked separately by the contractor.

TECHNICAL APROACH/OBJECTIVES

Approach:

The IFR shall be operated under flue gas recirculation with PM control for simulating firing conditions similar to those of the oxy-coal firing boilers currently under development. The objective shall be to achieve greater than 80% CO_2 concentration in the flue gas measured at the outlet of the furnace. Coal combustion flue gases have much significantly higher SO_2 concentration and low moisture content than those of natural gas combustion flue gases. The moisture content in the re-circulated combustion flue gas generated by the IFR shall be reduced substantially by passing the flue gas through a moisture condenser followed by an electric re-heater.

The coals tested in the project shall be identified and selected from commercial suppliers. Initial effort of the tests shall be focused on those coals which have been tested by major oxy-coal combustion organizations from academia and industry.

Objective:

Tests shall be conducted on APPCD's two existing combustion research facilities, the drop tube furnace and the Innovative Furnace Reactor (IFR). The drop tube furnace is a bench-scale system designed to study coal combustion under well controlled environment. The pilot scale, refractory-lined, down-fired furnace (150,000 Btu/hr nominal firing rate) which has been used to generate a coal combustion environment and flue gas cooling conditions similar to those of coal-fired utility boilers. The IFR is equipped with an electrostatic precipitator (ESP) for particulate matter (PM) control. Tests will be performed on this facility to evaluate the emissions and control from oxy-coal combustion. The IFR has been modified for firing natural gas and coal under simulated O_2 and CO_2 enrich conditions similar to those of oxy-natural gas and oxy-coal firing boilers currently under development by the industry. Recirculation of flue gas in the modified IFR's flue gas ductwork, is proposed in the testing of this WA. A laboratory scale CO_2 CPU unit which is compatible with the IFR combustion research facility will be installed in cooperation with Air Liquide. The potential of CPU technology to remove pollutants produced under oxy-coal and oxy-natural gas combustion conditions will be assessed.

QUALITY ASSURANCE

The contractor shall update the Quality Assurance Project Plan (QAPP) as required in Attachment #1 to the Statement of work for "Characterization and Control of Emissions from Oxy-Coal Combustion." After revision, the QAPP shall be reviewed and approved by the contractor work assignment leader and QA officer. Once it has obtained their approval, it shall be submitted to the EPA QA staff for review and approval. It shall be accompanied by a signature page that is signed by the contractor work assignment leader and QA officer to show that they have reviewed and approved the QAPP. It is the responsibility of the contractor work assignment leader to document this process. Upon receipt of the signed QAPP, the EPA work assignment manager and QA manager will review and approve the QAPP and they will add their signatures to the signature page. Any work involving environmental data shall not commence until the QAPP has received official approval from the EPA QA staff.

DELIVERABLES

The contractor shall deliver raw analytical data (computer files and data sheets) and reduced data in the form of Excel spreadsheets, pie charts, and graphs of the data collected for each experimental study.

SCHEDULE of DELIVERABLES

The contractor shall provide all the data listed as deliverables above to WACOR by the end of the period of performance.

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS: Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.
4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.
4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
4.5 Describe the method for uniquely numbering each sample.

4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5. MEASUREMENT PROCEDURES

5.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.

5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6. QUALITY METRICS (QA/QC CHECKS)

6.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

6.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

7.2 Describe data validation procedures used to ensure the reporting of accurate project data.

7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).

7.3.1 If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

7.3.2 If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

7.4 Describe data storage requirements for both hard copy and electronic data.

8. REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

REFERENCES

Provide references either in the body of the text as footnotes or in a separate section

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-008

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017
Base Option Period Number 1

Title of Work Assignment/SF Site Name: Adv.Combust. Technol.

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: section 2

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:
The purpose of this amendment is to revise the PWS. Task 5 is hereby added. All changes appear in bold.

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Chun-Wai Lee
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7663
FAX Number:

Project Officer Name Robin S. Harris
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0955
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name Candice Charlton
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2007
FAX Number:

Performance Statement of Work

Amendment 1

WA Title: Environmental Implication of Advanced Combustion Technologies

WA #:1-008 WACOR: C. W. Lee

Contract #: EP-C-15-008 Alternate WACOR: Bill Linak

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (PSOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

The primary objective of this project is to investigate the transformation of air pollutants under simulated oxy-coal and oxy-natural gas firing conditions. The effects of this unique combustion environment on the performance of existing air pollution control devices such as fabric filter (FF) and electrostatic precipitator (ESP), wet scrubber, and selective catalytic reduction (SCR), will be evaluated. The potential of the compression and purification (CPU) technology to remove pollutants produced under oxy-coal and oxy-natural gas combustion conditions will also be assessed.

BACKGROUND

Oxygen enrich coal (oxy-coal) combustion as applied to utility coal boilers has been considered one of the promising advanced technologies for mitigating global climate change caused by emissions of CO_2 from coal-fired power plants. This emerging advanced combustion technology currently under development essentially involves process modifications to remove ~80% of volumetric input flow (nitrogen) so as to produce a concentrated CO_2/H_2O exhaust amenable to further processing, compression, and sequestration. There is very little information on how pollutant species such as sulfur, fuel nitrogen, ash, metals, Hg, potential organic hazardous air pollutants (HAPs), etc. will behave and be transformed under the unique conditions of oxy-coal combustion and also the effects of this unique environment on the performance of existing pollution control devices. These transforming pollutant species are likely to affect the operation of different boiler and pollution control systems in both adverse and perhaps beneficial ways. Further, emissions that would normally escape controls and be released as air emissions (O_2, SO_2, SO_3, NO, NO_2, ultrafine ash and metals, Hg, Se, and organic HAPs) now may be compressed and sequestered with the CO_2 and affect its chemistry during transport and in geological storage. In this project, the effect of oxy-coal combustion on the

formation and behavior of these pollutants and the effect of this environment on the performance of existing pollution control devices will be investigated.

There is also a significant lack of understanding regarding the environmental issues associated with the CO_2 compression process following the oxy-combustion. Key questions include: (1) what flue gas components, compositions, and concentrations can be processed by compression and purification units (CPUs) and what additional pretreatment is required; (2) how do flue gas species partition to the various CPU effluents; (3) how do process changes on the combustion side that affect CPU operation and partitioning; (4) what purity of CO_2 produced from the CPU is required to ensure safe, very long-term, geologic sequestration; and (5) is it possible for trace levels of impurities (such as oxygen, nitrogen, argon, acids, particles, metals, CO, organics, etc.) to be compressed and sequestered with the CO_2? Air Liquide, a leading industrial gas provider, has developed a compression and purification technology concept to capture, compress, and purify CO_2 generated from the oxy-coal combustion process for sequestration purposes. The process is designed to process the CO_2-enriched flue gas generated from the oxy-coal combustion process through compressing and condensing CO_2 to separate it from other condensable and non-condensable flue gas components for pipeline transportation and geologic sequestration. The multi-stage compression and purification unit (CPU) process can also separate pollutants and impurities from the flue gas. In contrast to existing conventional coal-fired power plants, this process has the potential to produce near zero emissions of air pollutants. APPCD and Air Liquide are collaborating on their experimental research efforts for evaluating the potential of CPU technologies to reduce pollutants from oxy-coal combustion under a Cooperative Research and Development Agreement (CRADA) with EPA. The objectives of research are: to examine different flue gas conditioning and CPU configurations options, and how these affect partitioning, emissions, and potential CO_2 purity and; to validate the efficiency of various CPU process parameters to partition and remove pollutant species (SOx, NOx, Hg, PM, H_2O, CO, organic VOCs, etc.).

SCOPE

TASK 1. Work Plan, Reporting, Budget, And WA Management

The contractor shall prepare and deliver to the WA manager (WAM) a work plan and budget within 20 days of WA effective date. The work plan shall include a description of how the contractor shall accomplish each task, along with a breakdown, per task, level of effort by professional level, a cost breakdown, and any underlying assumptions used. The contractor shall conduct activities necessary to manage the WA, including at least weekly communication with the EPA WAM. When responding to this WA, the contractor shall assume the responsibility to operate APPCD's Innovative Furnace Reactor (IFR). The contractor shall update the existing Quality Assurance Project Plan (QAPP) under the direction of the WAM as specified in Attachment #1. Work involving environmental data shall not commence until the QAPP has received official approval from the EPA Quality Assurance Staff. The contractor shall comply with all requirements as delineated on Attachment #1 to the SOW.

TASK 2 Drop Tube Furnace Experiments

Experimental studies shall collect and analyze gas and particle emissions as a function of oxy-coal operating parameters (O_2, CO_2, H_2O, and temperature). The drop tube furnace shall be operated according to design specifications and establish operating conditions for producing coal combustion aerosol. The furnace has been designed for characterization of the physical and chemical characteristics of drop tube furnace emissions during combustion of pulverized coal. This characterization shall provide data that shall be used to set operating parameters, such as fuel and oxygen feed rates and corresponding exhaust gas characteristics. Quantities to be measured include air and coal feed rates, outlet gas temperature, particle size distribution, and mass emission rates, particle compositions, O_2, CO, NO_x, SO_2, H_2O, and CO_2 gas concentrations. The contractor shall provide support and expertise for sampling and characterization of inorganic and carbonaceous particulate matter emissions.

TASK 3. IFR Experiments

Operation of the IFR

An existing QAPP shall be updated by the contractor for this particular Task. The contractor shall not begin data collection until the QAPP is approved by EPA Quality Assurance Staff. The contractor shall assist in the operation of the IFR. This shall include but not be limited to: natural gas, pulverizing coal, operating the IFR under air- and oxygen-firing modes including the associated air pollution equipment, removing ash and scrubber residue from the facility, and operation of the flue gas sampling system.

Flue Gas Sampling and Analysis

The contractor shall provide support and expertise in vapor-phase sampling for flue gas. This shall include, but not be limited to CO_2, CO, O_2, SO_2, NO_x and total hydrocarbon (THC) measurements taken with continuous emission monitors (CEMs). The contractor shall also provide support and expertise on sampling and characterization of other pollutants which shall be included but not limited to fly ash and metals, Hg, Se, As, and organic hazardous air pollutants (HAPs).

Effect of oxygen enriched combustion on PM emissions and VOC emissions

The contractor shall operate the IFR under oxy-coal firing mode for evaluating the effect of oxy-coal firing on the control of particulate matter (PM). A new electrostatic precipitator (ESP) has been installed recently to the IFR for removing PM from the flue gas in order for recycling most of the flue gas back to the IFR furnace. Flue gas recyling is essential in all oxy-combustion processes. The objective of this subtask is to evaluate the PM control efficiency of the ESP operated under different voltages and current conditions during oxy-coal combustion. The efficient control of PM is very important for the safe operation of the oxy-coal combustion process. The contractor shall provide support and expertise for sampling PM simultaneously at both the inlet and outlet of the ESP using modified EPA Method 5. The contractor shall also provide support and expertise for the characterization of the PM passing through the inlet and outlet location of the ESP

using on-line PM measurement instruments including scanning mobility particle analyzer/aerodynamic particle sizer (SMPS/APS) and the laser-based total PM analyzer made by SICK. The combustion conditions of all the PM control tests will be well characterized. This shall include, but not be limited to CO_2, CO, O_2, SO_2, and NO_x measurements taken with the continuous emission monitors (CEMs). The contractor shall also provide support and expertise on measurements of other specialty gases that are possibly presented in oxy-coal combustion such as N_2O and N_2.

The contractor shall operate the IFR under both oxy-natural gas and oxy-coal firing modes for evaluating the effect of oxygen enriched combustion on emissions of volatile organic compounds (VOCs). The objective of this sub-task is to characterize VOC emissions from both oxy-natural gas combustion and oxy-coal combustion under different IFR furnace operating conditions. The contractor shall provide support and expertise for sampling VOC emissions using the SUMMA canisters. The VOCs samples contained in the canisters will be analyzed using gas chromatography coupled with mass spectrometry (GC/MS) by the existing organic lab set up in the Emissions Characterization & Prevention Branch (ECPB) for measuring VOC emissions from different combustion sources. The contractor shall also provide support and expertise on sampling and characterization of other pollutants such as organic HAPs.

Purchasing of Expendable Supplies

The contractor shall be responsible for purchasing general expendable supplies required to maintain operation of the IFR including the CPU. The WAM shall provide approval for any purchases related to the supplies listed below.

These supplies shall include, but not be limited to:

a) Calibration, supply and carrier gases for analytical systems

b) Valves, tubing and piping

c) Compression fittings

d) Coal and transportation of the coal to EPA's RTP, NC facility

e) Chemicals and reagents including hydrated lime for the wet scrubber

f) Sorbent tubes and other gas-sampling consumables

TASK 4. CPU Installation and Testing

The contractor shall provide technical support to APPCD in the collaborative CPU research with Air Liquide. This support shall include the construction and installation of a laboratory scale CO_2 CPU unit compatible with the IFR combustion research facility that will be used for conducting experiments to evaluate pollutant and purification process effects in oxy-coal combustion systems. Detailed designs for the CPU are being provided by Air Liquide as part of a CRADA with EPA. EPA will

provide the large capital components and as many of the small components (valves, fittings, mass flow controllers, meters, etc.) as practical. The contractor shall coordinate through the WACOR with Air Liquide for addressing technical issues associated with the compatibility of the CPU design and the IFR facility. The contractor shall provide technical support to APPCD to assemble and install the laboratory scale CO_2 CPU and integrate the CPU with the IFR and its SCADA control system. The contractor shall assemble individual components and integrate the CPU within the IFR combustor and its SCADA control system following the design provided by Air Liquide. Many components will be provided by EPA, there are many small components that will need to be customized and constructed on-site.

TASK 5. CPU Shakedown Tests

The contractor shall conduct shakedown tests of the CPU after the unit is installed. The CPU is designed for extensive treatments of the CO_2-enriched flue gas generated from oxy-combustion in highly integrated operations for producing an ultra-pure liquid CO_2 required for geologic sequestration. The treatments include selective removal of moisture by permeation membrane, compression, adsorption of trace moisture from pressurized flue gas, pre-cooling followed by cryogenic cooling of flue gas (below minus 60 degrees Celsius) for separating liquid CO_2 from the flue gas which is enriched with O_2, releasing the O_2-enriched exhaust gas into the atmosphere safely, and heating the liquid CO_2 stream for releasing the CO_2 gas safely into the atmosphere. The contractors shall conduct shakedown test to ensure individual treatment processes are operated properly as they are designed in the integrated CPU operation. The operation involves a continue multiple phase flow (gas and cryogenic liquid) with repaid changes in temperature, pressure, concentration of O_2, and velocity are occurring either consecutively or concurrently in lab-scale equipments is highly unusual. The malfunction of a CPU component can create hazardous conditions such as rapid pressure build up or elevated O_2 concentration. The contractor shall evaluate scenarios that could cause potential hazardous operating conditions of the CPU and provide remediation for such conditions. The contractor may consult with the process design experts provided by Air Liquide, EPA's CRADA collaborator, for resolving any technical and safety issues identified from the shakedown tests. The contractor shall prepare operating procedures for the safe operation CPU based on experience gained and results obtained from the shakedown tests.

The contractor shall maintain strict control of all Confidential Business Information (CBI) provided by Air Liquide through the WAM for both Tasks 4 and 5 in accordance with the contract terms and conditions.

TASK 6. Maintenance and Repair of Facility

The contractor shall modify, maintain, operate, and make improvements to the existing drop tube furnace and the IFR facility, and provide all necessary hardware. The two facilities shall also include any instrumentation required to maintain safe and continuous operating conditions. The contractor shall provide the labor necessary to maintain and repair the IFR including the CPU with associated air pollution equipment such as ESP and other auxiliary equipment. Examples include repairing glassware, calibrating nozzles, pitot tubes, dry gas meters (DGMs), tracking equipment inventories, etc. Conduct of specific actions will be approved in writing by the WACOR prior to initiation of any identified support action. All costs (labor and ODC) incurred from this task shall be tracked separately by the contractor.

TECHNICAL APROACH/OBJECTIVES

Approach:

The IFR shall be operated under flue gas recirculation with PM control for simulating firing conditions similar to those of the oxy-coal firing boilers currently under development. The objective shall be to achieve greater than 80% CO_2 concentration in the flue gas measured at the outlet of the furnace. Coal combustion flue gases have much significantly higher SO_2 concentration and low moisture content than those of natural gas combustion flue gases. The moisture content in the re-circulated combustion flue gas generated by the IFR shall be reduced substantially by passing the flue gas through a moisture condenser followed by an electric re-heater.

The coals tested in the project shall be identified and selected from commercial suppliers. Initial effort of the tests shall be focused on those coals which have been tested by major oxy-coal combustion organizations from academia and industry.

Objective:

Tests shall be conducted on APPCD's two existing combustion research facilities, the drop tube furnace and the Innovative Furnace Reactor (IFR). The drop tube furnace is a bench-scale system designed to study coal combustion under well controlled environment. The pilot scale, refractory-lined, down-fired furnace (150,000 Btu/hr nominal firing rate) which has been used to generate a coal combustion environment and flue gas cooling conditions similar to those of coal-fired utility boilers. The IFR is equipped with an electrostatic precipitator (ESP) for particulate matter (PM) control. Tests will be performed on this facility to evaluate the emissions and control from oxy-coal combustion. The IFR has been modified for firing natural gas and coal under simulated O_2 and CO_2 enrich conditions similar to those of oxy-natural gas and oxy-coal firing boilers currently under development by the industry. Recirculation of flue gas in the modified IFR's flue gas ductwork, is

proposed in the testing of this WA. A laboratory scale CO_2 CPU unit which is compatible with the IFR combustion research facility will be installed in cooperation with Air Liquide. The potential of CPU technology to remove pollutants produced under oxy-coal and oxy-natural gas combustion conditions will be assessed.

QUALITY ASSURANCE

The contractor shall update the Quality Assurance Project Plan (QAPP) as required in Attachment #1 to the Statement of work for "Characterization and Control of Emissions from Oxy-Coal Combustion." After revision, the QAPP shall be reviewed and approved by the contractor work assignment leader and QA officer. Once it has obtained their approval, it shall be submitted to the EPA QA staff for review and approval. It shall be accompanied by a signature page that is signed by the contractor work assignment leader and QA officer to show that they have reviewed and approved the QAPP. It is the responsibility of the contractor work assignment leader to document this process. Upon receipt of the signed QAPP, the EPA work assignment manager and QA manager will review and approve the QAPP and they will add their signatures to the signature page. Any work involving environmental data shall not commence until the QAPP has received official approval from the EPA QA staff.

DELIVERABLES

The contractor shall deliver raw analytical data (computer files and data sheets) and reduced data in the form of Excel spreadsheets, pie charts, and graphs of the data collected for each experimental study.

SCHEDULE of DELIVERABLES

The contractor shall provide all the data listed as deliverables above to WACOR by the end of the period of performance.

Revision 0 10/2008

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS: Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.
4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.
4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
4.5 Describe the method for uniquely numbering each sample.

4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5. MEASUREMENT PROCEDURES

5.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.

5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6. QUALITY METRICS (QA/QC CHECKS)

6.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

6.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

7.2 Describe data validation procedures used to ensure the reporting of accurate project data.

7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).

7.3.1 If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

7.3.2 If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

7.4 Describe data storage requirements for both hard copy and electronic data.

8. REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

REFERENCES

Provide references either in the body of the text as footnotes or in a separate section

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-009

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008	Contract Period 04/01/2015 To 03/31/2017 Base X Option Period Number	Title of Work Assignment/SF Site Name: 1-009
Contractor: JACOBS TECHNOLOGY INC.	Specify Section and paragraph of Contract SOW: 4, 6	

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — **Accounting and Appropriations Data** — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Brian Gullett	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-1534 FAX Number:
Project Officer Name: Robin Baily	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Mark Cranley	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

PWS Work Assignment, 1-09

Contract No. EP-C-15-008

Period of Performance April 1, 2016 – March 31, 2017

Open Area and Trace Emission Sampling

Short Name: "TRACE EMISSIONS"

I. BACKGROUND

EPA is developing methods to sample open area and trace pollutant sources for a broad array of pollutants and source types. These methods include aerial and ground-based mobile measurements as well as stationary measurements. These methods are applicable to a variety of sources such as prescribed fires, landfills, agricultural operations, ordnance disposal, waste combustors, and area industrial sources. These measurements result in concentration values and emission factors. Sampling fires, for example, makes use of the carbon balance method to determine emission factors. Stationary source emissions can require specialized sampling instruments for fast pollutant detection. Emissions of interest include, PM, black carbon, organics, and metals, among others.

This proposed work represents a continuation of previous work at EPA.

II. PURPOSE

Open area source measurements

Field and laboratory-based measurements of open area sources, such as burning, will be used to derive emission factors which can be input into dispersion models for predicting near-source concentrations and exposures. Potential field sources include controlled-burn

agricultural fields, prescribed forest burns, ordnance disposal, wildfires, landfills and landfill fires, industrial flares, lagoons, and large area industrial facilities.

The sampled data will be used to derive emission factors and to make a comparison between field testing and laboratory simulations, as available. Other than emission factor data, the project intends to establish a sound scientific basis and agreement on methodology on how experiments should be undertaken to generate emission factors that will be scientifically accepted.

Point source measurements

Sampling for trace organic air toxics, as well as accompanying pollutants, is necessary for source quantification, emissions prevention, and emissions control. Advanced and standard techniques will be used to quantify pollutants and the operating parameters of the facility that result in these pollutants.

Background Information and Special Instructions

- The Contractor is expected to use government furnished equipment (GFE) for the work. This shall include sampling equipment, aerial and ground-based sampling equipment, the open burn test facilities, the Resonance Enhanced Multiphoton Ionization (REMPI)/gas chromatograph(GC)/preconcentrator (PC) system, the organic support analytical laboratory equipment, and related support equipment.
- The Contractor shall supply other equipment as needed including glassware and heated sampling lines.
- The Contractor is expected to assist with a 10-day OBTF testing program at the EPA
- The Contractor is expected to prepare for a 10-day (plus travel) testing program with REMPI at a Northeast U.S. industrial facility and, as directed by the work assignment contracting officer's representative (WACOR)
- The Contractor is expected to assist with logistical, equipment, and analytical support preparations for a 10-day field testing campaign(s) for open area emission sampling in the continental U.S.

- Facility operating manuals for the above-mentioned devices shall be followed. Analytical methods and sampling procedures shall follow EPA protocols where practical and applicable.

III. STATEMENT OF WORK

The Contractor shall undertake laboratory- and field-based work in the following areas:

Task 1. Emissions from Simulated Open Area Burning

It is anticipated that the contractor shall assist in conducting 10 burn test-days in the large open burn test facility (OBTF) using biomass or biomass-derived materials or the small, temporary burn test facility with potentially alternative materials. At the direction of the WACOR, the contractor shall run the continuous emission monitor (CEM) sampling, biomass or fuel sorting and preparation, burn preparation, OBTF preparation, the conduct of the burn, and the facility clean up. The Contractor shall install and maintain CEMs as directed by the WACOR. The contractor shall analyze target analytes for chemical analysis, including, at the discretion of the WACOR, PM2.5 and PM10, black carbon, PXDD/PXDF, CO, CO2, volatiles, hydrocarbons, and PAHs, and related pollutants.

Task 2. Emissions from Field-Based Open Area Burning

It is anticipated that the Contractor shall provide logistical, equipment, and analytical support to one field sampling campaigns totaling 10-days including both ground and aerial sampling. Aerial sampling may involve lofting the 55 lb "Flyer" sampling apparatus and the 8 lb "Kolibri" sampling apparatus at the discretion of the WACOR. Tethers, winches, helium if needed, and aerial platforms will be supplied by the Contractor as necessary. All sampling will be done by others. The contractor, at the discretion of the WACOR, shall analyze target analytes for chemical analysis, including, at the discretion of the WACOR, PM2.5 and PM10, black carbon, PXDD/PXDF, CO,

CO2, volatiles, hydrocarbons, semi-volatiles, PAHs, and related pollutants.

Task 3. Electronic waste GEEP

The Contractor shall provide interpretation of existing data from the GEEP electronic waste recycling plant study done in the past. Their reporting will take the form of data assistance for a journal article or articles to report the results. The analysis shall include emission factors and material balances. Approximately 1 week time is anticipated.

Task 4. REMPI

A Cooperative Research and Development Agreement (CRADA) with Covanta involves a field diagnostic at one of its municipal waste combustors (MWC). The purpose of the diagnostic is to conduct sampling and monitoring to assess the cause of variations in emissions of polychlorinated dibenzodioxin/dibenzofuran. This will be accomplished by a combination of extractive sampling and laboratory analysis as well as near real time analysis. In accord with this, the Contractor shall use an existing Quality Assurance Project Plan (QAPP), run preparatory maintenance tests on the PC/GC/REMPI, and gather and assess equipment/standard/gas/supply needs, in anticipation of future (not this Work Assignment) travel to likely a New England site to conduct a field diagnostic, operate sampling equipment, provide support with laboratory analyses, conduct data analyses, and report on the field testing efforts.

When and if this happens....

Eight days of field testing plus travel days will be involved. The Contractor shall transport equipment including sampling probes, heated lines, power cables, chemicals, sampling boxes and meters, and the concentrator/gas chromatograph/resonance enhanced multiphoton ionization (REMPI) system. Approximately 60 M23 samples, 15 Tenax samples for volatile organic carbons, and 85 Tenax/REMPI samples are predicted. The Contractor is referred to a previous, similar QAPP effort for WA4-08 "Southeastern Public Service Authority Power Plant Measurement Test

Campaign IV", February 2009. Current plans, subject to change, are for September testing.

Task 5. Maintenance

The Contractor shall provide support to maintain test facilities and equipment therein including the open burn test facility, ground ATVs and trailers, sampling equipment, aerial and ground sampling equipment, and REMPI system. About 6 weeks time is anticipated.

IV. Quality Assurance.

The Contractor shall adhere to and ensure that all applicable QA/QC and safety and health rules and requirements are met. Work involving environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff. Since this work covers measurement to determine emission factors, the contractor shall document quality assurance/control data as required for Measurement Projects (see Attachment #1) to this Statement of Work. Work involving environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff.

The modified QAPP shall be reviewed and approved by the ARCADIS work assignment leader and QA officer. Once it has obtained their approval, it shall be submitted to the EPA QA staff for review and approval. It shall be accompanied by a signature page that is signed by the ARCADIS work assignment leader and QA officer to show that they have reviewed and approved the QAPP.

It is the responsibility of the ARCADIS work assignment leader to document this process. Upon receipt of the signed QAPP, the EPA work assignment manager and QA manager will review and approve the QAPP and they will add their signatures to the signature page. Work involving environmental data shall not commence until the QAPP has received official approval from the EPA QA staff.

IV. DELIVERABLES AND SCHEDULE

The Contractor shall ensure that all reporting requirements as specified by the Contract are met.

1. Weekly Meetings and E-Mail Reports: The WACOR and contractor's project manager shall hold biweekly project meetings to discuss Task-specific progress, issues, and action items. The contractor project manager shall send an e-mail report to the WACOR within one business day of this meeting, unless otherwise specified by the WACOR. The e-mail report shall:

- Specify work goals and priorities for each Task under this work assignment;
- Document action item issues planned in the last weekly meeting for each Task;
- Provide expenditure reports on subtasks within this WA at the direction of the WACOR;
- Specify the status of outstanding Task-specific test plans, QA plans, and safety plans; and
- Itemize issues and concerns that need resolution for each Task.

2. Monthly Task Progress and Cost Reports: The contractor's monthly report to EPA shall summarize work activities (accomplished and planned) for each Task in this work assignment, including the status of applicable test, QA, and safety plans. The monthly report shall also detail labor costs and ODC charges. The Contractor shall subdivide project Task costs at the request of the WACOR and report them to the WACOR as requested.

3. Health and Safety Protocols: Health and safety protocols for each Task shall be updated or prepared as required by the EPA ERC and APPCD safety personnel. These protocols shall be approved by the WACOR and safety personnel prior to the conduct of any testing.

4. Quality Assurance Project Plan (QA/QC) and Test Plans: The contractor shall perform the activities described in these Tasks with reference to the QAPPs entitled

- U.S. EPA Evaluation of Dioxin Emissions Pre-testing Phase,
- Burning CCA-Treated Wood in the Open Burn Test Facility (OBTF),
- Development of analysis methods for the study of PCDD/F TEQ indicators, and
- Evaluation of Dioxin-Like Emissions from Residential Wood Combustion.
- Determination of Emission Factors from Open Burning and Open Detonation of Military

Ordnance and its Addendum

5. Facility Manual(s): Relevant manuals shall be reviewed, updated, and approved as specified in QA requirements for facility manuals provided by the EPA QA office.

6. RCRA Compliance reports for activities conducted in the RCRA and Air permitted facility (as relevant): These reports shall be provided to the WACOR and EPA personnel responsible for the permitted facility, upon request.

7. Additional Information.

- Additional instructions will be conveyed in writing by the WACOR in accordance with the "Technical Direction" clause.
- Technical support travel to the field sampling locations mentioned above.
- Applicable sections of the contract include 1.1-1.6. 1.8, 2.0 – 7.0.

V. MILESTONES

The following milestones are identified:

- 10 days after WA award. The Contractor shall prepare a Work Plan and deliver to the PO and WACOR.
- 7 days after Work Plan approval. The Contractor shall complete preparation of QA plans for each Task above, as directed by the WACOR and the available testing schedule.
- TBD*. The Contractor shall assist with the conduct of OBTF fuel burns (Task 1) including analytical determinations, procedural and QC documentation, and data QC checks.
- TBD*. The Contractor shall complete logistical, equipment, sampling, and analytical support for one field samplings effort (Task 2).
- TBD*. The Contractor shall prepare for complete testing and laboratory analysis on one industrial field sources (Task 4) including analytical determinations, procedural and QC documentation, and data QC checks.

➢ Attachment 1. NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS: Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.
4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.
4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
4.5 Describe the method for uniquely numbering each sample.
4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5. MEASUREMENT PROCEDURES

5.1. Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.

5.2. If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6. QUALITY METRICS (QA/QC CHECKS)

6.1. For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

6.2. Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

7.2 Describe data validation procedures used to ensure the reporting of accurate project data.

7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).

7.3.1 If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

7.3.2 If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

7.4 Describe data storage requirements for both hard copy and electronic data.

8. REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-010

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008	Contract Period 04/01/2015 To 03/31/2017 Base Option Period Number 1	Title of Work Assignment/SF Site Name: Biomass Burning Emissions
Contractor: JACOBS TECHNOLOGY INC.	Specify Section and paragraph of Contract SOW: 1, 2, 3, and 4	

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 11/10/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Amara Holder	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-4635 FAX Number:
Project Officer Name: Robin S. Harris	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-0955 FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Candice Charlton	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-487-2007 FAX Number:

Performance Work Statement

WA Title: Biomass Burning Emissions Measurement

WA #: 1-010 WACOR: Amara Holder

Contract #: EP-C-15-008 Alternate WACOR: Brian Gullett

PERIOD OF PERFORMANCE

CO Issuance through March 31, 2017.

SUMMARY OF OBJECTIVES

The key objectives of this work assignment are to:

1. Provide support in the design and construction of an automated emissions sampling system.
2. Prepare and maintain the open burn test facility.
3. Obtain and prepare fuels for biomass burning experiments and provide analysis of fuels and samples.
4. Provide support in the setup and operation of continuous emissions measurements.

BACKGROUND

Wildland fires are the largest contributor to particulate matter emissions in the United States. However, the emissions from open burning and their impact on surrounding communities are not well constrained due in part to the large uncertainty in emission factors of pollutants. Although numerous laboratory studies and several field measurement campaigns have been carried out, accurate emission factors for particulate matter including compositional information are scarce. Furthermore, these data are averaged over the duration of a burn and do not account for differences in emission rates and compositions during the burn. Open burning of biomass can undergo multiple combustion phases (flaming, smoldering, glowing) both simultaneously and sequentially. The amount of fuel consumed or time spent in a combustion phase can vary depending upon the type of fire (wildfire or prescribed) and the type of fuels consumed in the fire (e.g. crown fuels, litter, or peat).

This project is an expansion of an initial effort to characterize gas phase and particulate matter emissions from the combustion of biomass fuels resolved by combustion phase. From this initial work, the EPA WACOR has developed a basic design for an automated sampling platform and experimental plan which will be provided to the Contractor to guide for the development of a more expansive sampling system.

SCOPE

The scope of this work assignment is to provide support in the development of sampling methodology and materials and support in carrying out biomass burning experiments. This work assignment will cover the construction of an automated emissions sampling system, preparation and maintenance of the open burn test facility, and general support for biomass burning experiments. Experimental support includes obtaining and preparing fuels, sample analysis, operation of continuous emissions measurements. Each of these activities are described in detail below.

TECHNICAL APROACH/OBJECTIVES

Task 1: Support the design and construction for an automated emissions sampling system

A sampling system design shall be provided by the WACOR to the Contractor. The Contractor shall provide technical expertise regarding speciated mercury measurement and analytical support for the inclusion of this measurement to the sampling system.

The Contractor shall construct the automated emissions sampling system from materials provided by EPA and supplemented with additional materials as the design necessitates.

Deliverable 1.1. The Contractor shall provide a draft technical design for including speciated mercury within 45 days of the initiation of the WA initiation.

Deliverable 1.2. The Contractor shall provide an automated emissions sampling system as specified in the finalized design 90 days from WA issuance.

Task 2: Prepare and maintain the Open Burn Test Facility

The Contractor shall be responsible for preparing the Open Burn Test Facility for burning experiments and maintain all materials associated with the facility. The facility consists of a control room, stainless burn chamber, and a high volume blower which pulls ambient air into the burn chamber and through an exhaust duct out to the blower. The Contractor shall be responsible for cleaning the chamber on an as needed basis. It is expected that cleaning will be needed approximately 5 times as major fuel changes occur. The Contractor shall be responsible for the maintenance or repair of the blower to minimize interruptions to the experimental schedule.

Task 3: Obtain and prepare biomass fuels for biomass burning experiments and provide analysis of fuels and samples

The Contractor shall obtain and prepare biomass fuels for burning as specified by the WACOR. It is estimated that approximately 5 fuels will be burned during the period of performance. Any fuel remaining after experimentation shall be disposed of by the contractor. For each type of fuel the Contractor shall provide analysis as specified by the WACOR. Analysis of the fuel will include but not be limited to: proximate analysis, ultimate analysis, elemental analysis of trace compounds of interest (for example, Pb or Hg).

The Contractor shall provide analysis of emissions samples provided by EPA on an as needed basis. It is estimated less than 100 samples will be generated for analysis. Emissions analysis may include and are not limited to:

- Gravimetric analysis
- Ion chromatography
- Elemental analysis
- Elemental carbon and organic carbon analysis
- Speciated mercury analysis

Task 4: Provide support in the setup and operation of continuous emissions measurements.

The Contractor shall provide support as necessary in the assembly of a continuous emissions measurement (CEM) bench. The assembly shall be completed only once at the initiation of the project. Assembly of the CEM bench will include, but not be limited to:

- Heated sample lines and controllers
- Heated filter and controller
- Heated sampling pump and controller
- Water removal system
- Carbon dioxide/carbon monoxide analyzer
- Total hydrocarbon analyzer
- Data acquisition system

The CEM bench shall be constructed from on-site materials provided by EPA and the contractor shall supplement with any necessary additional materials.

The Contractor shall operate the bench during routine experimentation according to EPA measurement methods as provided by the WACOR. The Contractor shall purchase calibration gases as necessary to meet method requirements. The Contractor shall provide data analysis to meet method requirements. Environmental data obtained during the testing shall be subject to quality assurance requirements (Attachment 1 to the PWS). The Contractor shall provide a review of the quality assurance project plan provided by the WACOR and provide edits if necessary to cover environmental data obtained by the Contractor.

WA SPECIFIC MATERIALS

Tasks 1 and 4 may require procurement of materials to support the research efforts. Materials may include components to fabricate the sampling apparatus as described in Task 1 and any necessary components needed to complete the assembly of the CEM bench described in Task 4.

QUALITY ASSURANCE

The Contractor shall adhere to and ensure that all applicable QA/QC and safety and health rules and requirements are met. Since this work covers measurements to determine emission factors, the Contractor shall document quality assurance/control data as required for Measurement Projects (see Attachment #1) to this Performance Work Statement.

A quality assurance project plan (QAPP) will be developed by EPA and provided to and approved by the contractor. Once it has obtained approval, it shall be submitted to the EPA QA staff for review and approval. It shall be accompanied by a signature page that is signed by the contractor's work assignment leader and QA officer to show that they have reviewed and approved the revised QAPP.

It is the responsibility of the contractor to document this process. Upon receipt of the signed QAPP, the EPA WACOR and QA manager will review and approve the QAPP and they will add their signatures to the signature page. Work involving environmental data shall not commence until the QAPP has received official approval from the EPA QA staff.

ATTACHMENT #1 TO THE STATEMENT OF WORK

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS: Include cover page, distribution list, approvals, and page numbers.

1. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

2. PROJECT DESCRIPTION AND OBJECTIVES

2.1 Describe the process and/or environmental system to be evaluated.
2.2 State the purpose of the project and list specific project objective(s).

3. ORGANIZATION AND RESPONSIBILITIES

3.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
3.2 Include a project schedule that includes key milestones.

4. SCIENTIFIC APPROACH

4.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
4.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
4.3 Describe the general approach and the test conditions for each experimental phase.

5. SAMPLING PROCEDURES

5.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.

5.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.

5.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.

5.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.

5.5 Describe the method for uniquely numbering each sample.

5.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

6. MEASUREMENT PROCEDURES

5.1. Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.

5.2. If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

7. QUALITY METRICS (QA/QC CHECKS)

6.1. For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

6.2. Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

8. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

8.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

8.2 Describe data validation procedures used to ensure the reporting of accurate project data.

8.3 Describe how the data will be summarized or analyzed (e.g., qualitative

analysis, descriptive or inferential statistics) to meet the project objective(s).

8.3.1 If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

8.3.2 If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

8.4 Describe data storage requirements for both hard copy and electronic data.

9. REPORTING

9.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

9.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

10. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-011

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name:

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Xiaoyu Liu
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-2459
FAX Number:

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name:
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Statement of Work

WA Title: The Fate and Transport Mechanisms Study of Semi-Volatile Organic Compounds (SVOCs) in Indoor Environment

WA #: WA 1-011 WACOR: Xiaoyu Liu

Contract #: EP-C-15-008 Alternate WACOR:

PERIOD OF PERFORMANCE:

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

The overall objective of this project is to study the fate and transport mechanisms of Semi-Volatile Organic Compounds (SVOCs) in indoor environment to support the U.S. Environmental Protection Agency's (EPA's) sustainability activities on chemicals of concern. This project is to develop analytical methods and test protocols for studying the fate and transport mechanisms of SVOCs indoors and to collect data on parameters for quantifying the fate and transport of SVOCs indoors including partitioning between sources and air, source and interior surface materials and interaction between indoor sources and dust.

BACKGROUND

Improving air quality and assuring the safety of chemicals are two of the seven priorities for EPA's future addressed by the EPA Administrator. EPA has created the Chemical Safety for Sustainability (CSS) research program to enhance scientific approaches for understanding current and emerging chemicals, and how this is essential for effective environmental decision making in the 21st century.

It is well known that humans are exposed to multiple pollutants from multiple sources via different pathways and routes in the real environments. Many of the EPA's priority pollutants, including polychlorinated biphenyls (PCBs), brominated flame retardants, perfluorinated compounds (PFCs), bisphenol A (BPA), phthalates, and pesticides, are SVOCs and non- volatiles that are released from a vast number of building materials and consumer products. Understanding the transport mechanisms of these compounds between sources, air, house dust, and interior surfaces in residential environment will help to characterize human exposures, develop/refine source-to-exposure-to-dose models, and develop strategies that

enlighten risk assessments and policy decisions to minimize exposures and to protect human health.

Little is known about SVOCs source and exposure mechanisms. Because of the lack of standards or reliable methods for characterizing SVOC sources, fate and transport, it is often the case that the advance of data collection for SVOCs is far behind model development. The critical data gap for indoor SVOC research includes: (1) emission rates, (2) sorption rates, (3) critical parameters for exposure modeling: material/air partition coefficients and solid-phase diffusion coefficients, sorption rate constants, concentration in the sources and (4) data to support the development of quantitative structure–activity relationship (QSAR) models and mass transfer models (including fugacity models) to predict the SVOC emissions and transport in indoor environments. Our research will directly support rapid prediction of chemical exposure under CSS by providing chemical concentrations and other parameters as part of the basic model input.

SCOPE

This WA is a continuation of WA 0-011. Under this WA, the Contractor shall provide technical support to EPA by developing analytical and sampling methods, and conducting chamber or other tests for SVOCs include but not limited to organophosphorus flame retardants (OP-FRs), including tris(2-chloroethyl) phosphate(TCEP), tris(1-chlor-2-propyl) phosphate (TCPP) and tris(1,3-dichloro-2-propyl) phosphate (TDCPP).

TECHNICAL APROACH/OBJECTIVES

The contractor shall conduct the following tasks:

Task 1. Process the Experimental Data Collected during WA 0-011.

Under WA0-011, the contractor has conducted three particle chamber tests. Due to the interruption of the urgent tire crumb project, the experimental data were not processed. The contractor shall compile the data for the finished tests and submit electronic data file to the WACOR.

Task 2. Set up Analytical and Sampling Systems for SVOC Tests

The SVOC research facilities will be used for the tire crumb project during April to August, 2016. The testing chambers and SVOC source chamber will be shut down during this time period. Once the tire crumb project finishes, the contractor shall set up chamber testing system, sample collection and extraction systems to resume SVOC study.

Task 3. Conduct Chamber Tests

The contractor shall conduct chamber or other tests to investigate the gas phase SVOC fate and transport on building materials and consumer products and to study the transport mechanisms between indoor SVOC sources and settled and/or suspended dust. For settled dust tests, this will include dust/source direct contact and air/dust partition using different type of dust and under different chamber conditions. The work plan will be developed with consultation of the WACOR.

Task 4. Support to ORISE Postdoc

The ORISE postdoc is developing test methods to measure key parameters for SVOC indoor modeling. The Contractor shall provide sampling and analytical support to the experiments conducted by the ORISE postdoc.

QUALITY ASSURANCE

This project will be QA category 3. The contractor shall adhere to the QA requirements as delineated in Attachment #1 to the PWS. A new QAPP will need to be written and submitted for approval, and that a QAPP for a similar previous work will be provided by the WACOR to aid in the development of the new QAPP. Work shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff.

DELIVERABLES and SCHEDULE of DELIVERABLES

The Contractor shall submit the QAPP within 30 days of receiving the directions from the WACOR.

The Contractor shall submit compiled data for the tests conducted under WA 0-011 no later than November 30, 2016

The Contractor shall finish at least 3 chamber tests for the three flame retardants (TCPP, TDCPP, and TCEP) by March 31, 2017. The Contractor shall also provide (1) test material information; (2) environmental data for each test; (3) sampling information; (4) analytical data in excel files. These shall be submitted to the WACOR within 10 business days after each new test.

The Contractor shall prepare MOPs for the experimental procedures.

The Contractor shall provide the EPA WAM monthly progress reports as specified in the contract. The Contractor shall alert the WACOR in advance if they expect a substantial delay in completing the task or submitting the deliverable.

The Contractor shall provide necessary health and safety protocol and documentation.

ATTACHMENT #1 TO The PERFORMANCE WORK STATEMENT (PWS) FOR MEASUREMENT PROJECTS

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,

http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function; 07/14/08 A-2

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,

http://www.epa.gov/quality/qs-docs/r2-final.pdf

□ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X **QAPP Requirements for Measurement Projects**

□ **QAPP Requirements for Secondary Data Projects**

□ **QAPP Requirements for Research Model Development and/or Application Projects**

□ **QAPP Requirements for Software Development Projects**

□ **QAPP Requirements for Method Development Projects**

□ **QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/

EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

---

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.

1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.

2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.

3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.

3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.

4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.

4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.

4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.

4.5 Describe the method for uniquely numbering each sample.

4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5 MEASUREMENT PROCEDURES

5.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.

5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6 QUALITY METRICS (QA/QC CHECKS)

6.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

6.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7 DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

7.2 Describe data validation procedures used to ensure the reporting of accurate project data.

7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).

7.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

7.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

7.4 Describe data storage requirements for both hard copy and electronic data.

8 REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-012

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008	Contract Period 04/01/2015 To 03/31/2017 Base X Option Period Number	Title of Work Assignment/SF Site Name: 1-012
Contractor: JACOBS TECHNOLOGY INC.	Specify Section and paragraph of Contract SOW: 1, 6	

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — **Accounting and Appropriations Data** — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Mark Mason (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-4835 FAX Number: 919-541-2157
Project Officer Name Robin Baily (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Mark Cranley (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

PWS – WA1-012

Short Title: SPF Emissions Methods

WA Title: Spray Foam Emission Measurement Method Development

WA #: WA 1-012 WACOR: Mark Mason

Contract #: EP-C-15-008 Alternate WACOR:

PERIOD OF PERFORMANCE:

The period of performance detailed in the Performance Statement of Work (SOW) shall be from April 1, 2016 through March 31, 2017.

SUMMARY OF OBJECTIVES

This project seeks to develop methods and data to characterize Spray Polyurethane Foam (SPF) insulation emissions during and following application. Data generated in this project will assist EPA and other stakeholders in developing effective risk management strategies and guidance regarding re-entry and re-occupancy of buildings insulated with spray polyurethane foam and assist stakeholders in understanding longer-term potential chemical emissions from SPF insulation. The data generated will also inform the CSS program Life-cycle and Human Exposure Modeling (LC-HEM) team in selection of a product or material for case study of the LC-HEM approach.

BACKGROUND

EPA, NIOSH, OSHA, the CPSC, and others are concerned about exposures of Spray Polyurethane Foam (SPF) insulation applicators, building tradesmen, occupants, and bystanders to isocyanates, flame retardants, amine catalysts, propellants, other SPFI reagents and reaction products that are emitted during and after SPF insulation application. SPF insulation products are used extensively to insulate building and seal air leakage pathways. Recent estimates place the number of buildings insulated in the U.S. with SPF insulation materials in the range of 70,000 to 100,000 per year. Because SPF products can be very effective in insulating buildings and reducing uncontrolled air leakage, SPF products have the potential to play an important role in reducing heating and cooling loads for buildings, a major source of energy consumption and greenhouse gas emissions.

SPF insulation is manufactured on-site using specialized equipment that mixes and blows SPF reagents onto target surfaces where, depending upon formulation and application, the reactants polymerize and expand to form either open or closed-cell

foam. SPF is produced using two-component, high and low pressure systems, as well as one-component systems contained in spray cans that are used for sealing air pathways around plumbing and electrical penetrations, window and door frames. Reagent containers for two-component systems range in size from 55 gallon drums used by commercial applicators to one to five gallon containers for use in low-pressure systems employed by professionals and available to DYI homeowners. One component systems are widely available in hardware and building product stores and typically contain 16 to 32 oz. of SPF insulation reagent in aerosol spray cans.

The chemical constituents of two-component systems consist of "A" side and "B" side chemicals that are mixed in a chamber of the spray gun. "A" side components consist of a mixture of Methylene diphenyl diisocyanate (MDI) and higher molecular oligomers of MDI (pMDI) whereas the "B" side contains proprietary mixtures of polyols, amine catalysts, blowing agents, surfactants, flame retardants, and propellants. When the product is applied, exothermic chemical reactions between "A" and "B" side components occur and the product expands rapidly to form open or closed cell foam. This initial expansion occurs within seconds or minutes of application. Additional reactions or curing may continue for an additional amount of time, e.g., 12 to 72 hours, depending upon formulation, substrate, and environmental conditions during application.

Some SPF compounds are known sensory irritants and sensitizers, e.g., isocyanate exposure is considered to be the leading attributable cause of workplace-related asthma. MDI irritates the eyes, irritates and sensitizes the respiratory tract and skin. Recently, MDI skin exposure has been shown to induce MDI-specific immune sensitivity and promote respiratory tract inflammation responses in animal systems. Pre-maternal exposure to isocyanates has been linked to increased risk of respiratory sensitivity in newborns. Amine catalysts may also cause respiratory tract, eye, and skin irritation and sensitization. Blowing agents may also irritate respiratory tract, eyes, and skin, and may have other central nervous system (CNS) effects. At least one of the flame retardants reportedly in use in SPF products has recently been listed as a Proposition 65 chemical in California.

Development of asthma has been linked to homeowners who reentered their home four hours after application of SPF insulation.(Tsuang and Huang, JOEM, Vol. 54, number 3, March 2012).Due to the increasing use of these products and reports of adverse health effects from some homeowners following installation of SPF insulation, there is a need for an improved understanding of the multi-pollutant emissions and exposures from SPF during application, curing, and post-curing and for improved understanding of the impact of environmental variables on emissions and cure time and movement of emissions from application site to inhabited spaces.

There are currently no consensus test methods, data, or models that characterize emissions from SPF products and relate emissions to potential exposure, hazard, and risk. Consequently, there is uncertainty regarding safe reentry time for trade

workers and safe re-occupancy time for building occupants following application of SPF. The uncertainty is due in part to the lack of consensus test methods that can be used to generate reliable data on which to base decisions. There is also little data available that characterizes the transport within a building of gases and particles that are generated during and following SPF installation.

SCOPE

Under this WA, the Contractor shall provide technical support to EPA's SPF emissions test method development and SPF emissions characterization research project by providing preparation of test chambers and sampling media for collection of emissions, sampling from chambers using selected media, analysis of samples, reporting of results, as specified below. EPA designed experiments may be conducted in micro chambers, small chambers, full-scale chambers and a research test house.

Experiments will be designed to identify emissions, characterize the time course of emissions, investigate the impacts of environmental variables (substrate, temperature, relative humidity, application depth, A/B side ratio, etc.), and investigate scaling between test systems of different sizes. The contractor shall provide support for data analysis and modeling of source emissions data generated in test chamber systems.

TECHNICAL APROACH/OBJECTIVES

The contractor shall conduct the following tasks:

Task 1. Provide sampling and analysis support to SPF emissions tests

EPA staff will produce on-site and acquire from other sources samples of SPF insulation. Potential sources include three low pressure two component products acquired by EPA for methods development research and samples of surrogate SPF insulation products that were designed, tested and are produced as needed by the ACC Center for Polyurethanes Industries (CPI) to support methods development within the industry and other stakeholders.

Samples of commercial products acquired by EPA will be prepared by EPA in a dedicated spray booth or emissions test chamber and placed by EPA or contractor staff into emissions test chambers supplied with clean, conditioned air. Volatile and semi-volatile organic compound emissions will be collected from the chamber air and concentrated on sampling media, such as Tenax, DNPH, XAD-2, and specialized denuder/filter combination samplers for collection of reactive isocyanates. The contractor may also collect, extract, and analyze surface wipe samples and air filter samples to identify and quantify emissions deposited on surfaces of test chambers and chamber system exhaust filters. The contractor shall identify and quantify

emissions collected in samples by thermal desorption/gas chromatography with mass spectral detection (TD-GC/MS), and liquid extraction with GC/MS analysis.

The contractor shall prepare chamber testing systems, prepare sample collection media and extraction systems for specific experiments.

1a. The contractor shall calibrate, operate and maintain the Markes TD-100 automated thermal desorption system coupled to an Agilent 7890A GC with Agilent 5970C MS for identification and quantification of volatile and semi-volatile organic compound emissions from SPF samples collected on thermal desorption sampling media in experiments outlined below and in other experiments that EPA WACOR will describe in technical directives.

1b. The contractor shall clean, prepare, track and QC Tenax. OVS (glass fiber filter/XAD-2), and mixed bed sorbent (Markes C3XX) sampling media for use in sampling per existing miscellaneous operating procedures (MOPs)

The contractor shall develop a MOP for use of OVS (glass fiber filter/XAD-2 cartridges) samplers for collection and analysis of flame retardants and amine catalysts during the application of SFP insulation.

1c. The contractor shall calibrate, operate and maintain a Hewlett-Packard 6890 GC with HP 5973 MS equipped with an 6890 series auto sampler for analysis of liquid extracts of B side reagents, surface wipe samples, deposition samples, and extracts of polyurethane foam semivolatile organic samplers (PUF) or OVS samplers, and SPF insulation sample extracts (see task 4).

1d. The contractor shall transfer data generated on analytical instruments into approved spreadsheets that become the electronic record of the experiment, and bring together all data relevant to the experiment. The contractor shall review data generated by the contractor for completeness, identify apparent outliers and flag data that do not appear to meet quality criteria. The contractor shall report apparent anomalies in the data, summarize and report indicators of data quality as specified by test plans and as required by an approved Quality Assurance Project Plan (QAPP).

1e. As resources permit, the contractor shall investigate and evaluate the performance of the Markes TD-100 sample recollection system. This feature of the TD-100 permits recollection and reanalysis of a portion of the gas stream that was split prior to injection into the gas chromatograph. The feature is important to source testing because it permits dilution and reanalysis of samples. This is particularly useful where mass of particular compounds may be beyond the calibration range. Preliminary observations have shown that some important SPF emissions, e.g., amine catalysts, are not quantitatively recovered during recollection. Additional work is needed to understand the utility and limitations of this feature for quantification of SPF insulation emissions.

1f. The contractor(s) shall be certified for use of supplied air respirator to enable preparation of foam for placement in test chambers, collection of samples and operation of instruments in and near areas of SPF application. Two contractor staff typically suit up to assist in initiating an experiment where EPA produces SPF insulation, and samples are cut from bulk material and placed in emissions test systems.

1g. The contractor shall clean emissions test chambers and conduct air and surface sampling and analyses to verify cleanliness of the test chamber system. Note that removal of flame retardant compounds from chambers surfaces may require extraordinary cleaning procedures, including pressure washing and solvent cleaning.

Task 2. Provide support to the ASTM Consensus SPF Methods Development Task

EPA expects to participate in an ASTM SPF methods development task by evaluating a draft protocol for testing cured SPF samples using micro chambers (dynamic headspace cells). SPF insulation samples will be produced at an American Chemistry Council (ACC)/industry stakeholder laboratory and shipped to participants for emissions testing using micro chambers and/or small chambers. Prior to testing, the contractor will be provided with a list of target compounds for the surrogate product testing. The contractor shall:

2a. Prepare calibration solutions for target compounds not currently in the calibration suite. Evaluate stability and compatibility of the compounds in the calibration standard mixtures in selected solvents.

2a. Initiate testing within 24 hours of receipt of the samples and conduct testing according to the draft ASTM protocol. Chamber air flow rate, temperature, relative humidity, and sampling schedule will be provided in the draft protocol. Specifics of the protocol and schedule will be determined after the April 30-May 1, 2015 ASTM Symposium on SPF Emissions Testing.

2b. In preparation for this task and to support scouting tests for SPF emissions tests in small and/or full-scale chambers, the contractor shall set up the recently acquired high temperature Markes M-CTE 250 micro chamber system, including connection to a clean air supply equipped with a humidification system to meet test conditions specified in the draft ASTM protocol and to meet conditions that may be required for scouting tests designed to provide information needed to inform design of small chamber and full-scale experiments. (Completed)

2c. The contractor shall prepare a MOP for set up and operation of the new Markes M-CTE 250 micro chamber/thermal extractor system and submit it for review and approval by the EPA PI and QA staff. (Submitted to EPA WAM)

Task 3. Provide support to Full-scale Emissions Testing experiments

The contractor shall assist EPA in setup of the 30 m^3 test chamber for characterization of application phase emissions. EPA expects to conduct a minimum of four full-scale chamber tests of two-component low pressure systems, following pilot tests that will be conducted by EPA with contractor sampling and analysis support, to develop a draft protocol.

3a. The contractor shall assist with chamber modifications and evaluation of the effectiveness of such modifications that are designed to prevent, control and minimize contamination of chamber surfaces, particularly flame retardants. (90% completed).

3b. The contractor shall assist in development and demonstration of sampling and analysis systems specific to quantification of propellants such as R 134a that are too volatile for analysis by the TD-100 GC MS system. (Completed, MOP in progress for the Innova 1412 Photo acoustic spectrophotometer by EPA).

3c. The contractor shall provide extraction, sampling and analysis of C3 samplers, PUF, OVS-XAD-2, filter and wipe samplers collected in full-scale tests.

Task 4. Provide analytical support to development and demonstration of an extraction method for flame retardants and amine catalysts from SPF insulation materials, including A and B side reagents and cured foam.

The Contractor shall provide analytical support (GC/MS analysis of extracts) to EPA staff in development and of a method to extract the flame retardant TCPP and other target compounds that have been observed in the emissions of SPF. Compounds will be selected in consultation with the EPA WACOR. This is an adaptation of the method used by Liu (WA0-011) to extract FRs from PUF samplers. Pilot tests have shown that the method may work for SPF insulation samples. However, no work beyond proof of concept has been conducted.

Task 5. Provide blinded quality control samples for specific sampling media and analysis systems as specified in test plans. The contractor shall:

5a. Provide blinded QC challenge samples to EPA analysts quantifying isocyanates using ISO 17734. The contractor shall spike ASSET samplers and impingers with known amounts of dibutylamine (DBA) stabilized isocyanate standards for LC-MS/MS analysis by EPA and/or a contract laboratory. EPA will provide the samplers and standard spiking solutions for dilution and spiking by the contractor.

5b. Identify a commercial laboratory with demonstrated ability to identify and quantify selected isocyanates collected on ASSET sampling media and impingers to provide independent verification of isocyanates identified and quantified by EPA. The laboratory shall have demonstrated capability to quantify methyl isocyanate, phenyl isocyanate, methylenediphenyl isocyanate (4,4'- and

2,4'-MDI), and polymeric MDI (3,4,5 ring MDI) at levels of <5 nano gram per sample.

5c. Spike DNPH solutions with known amounts of selected aldehydes and ketones for analysis by HPLC by EPA. The contractor shall make up unknown levels of standards for challenge standard solutions.

5d. Spike Tenax and C3 (Tenax/carbon adsorbent) wipe and PUF samplers for analysis by contractor staff. Contractor staff who are not analyzing the samples shall spike them.

WORK ASSIGNMENT SPECIFIC EQUIPMENT

Specific equipment that will be utilized by the contractor for this WA include:

Markes µCTE-250 micro chamber system located in E383

Markes TD-100 thermal desorption system with Agilent GC MS located in E383

Agilent GC MS equipped with liquid auto sampler located in E383

53 L small chambers located in the high bay (H106)

QUALITY ASSURANCE

The contractor shall adhere to the QA requirements as delineated in Attachment #1 to the Statement of Work. A revised QAPP will soon be submitted for approval. Work shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff.

DELIVERABLES and SCHEDULE of DELIVERABLES

QAPP

Micro chamber, small chamber and full-scale chamber experiments as detailed in the PWS

Phase 1 data for incorporation into the FY16 EPA draft internal report

Revised EPA report containing Phase 2 test results

SCHEDULE of DELIVERABLES

An internal EPA report for the project is due in the fourth quarter of FY16. The report will be based primarily upon micro chamber, small chamber, and full-scale chamber emissions tests conducted in the first three months of the work assignment period (Phase 1). An aggressive test schedule is required to produce sufficient data for the report. The work is expected to be conducted in two phases:

Phase 1: April, May, June, July

1. Conduct post curing micro chamber tests for products 1, 2, and 3 utilizing the draft ASTM protocol to inform full-scale test sampling and provide data for developing source emissions models and data for evaluating scaling between chambers of very different sizes.
2. Conduct replicate full-scale emissions tests that include application, cure, and post application emissions characterization at a set of standard conditions and scaled to the area specific flow rate used in the ASTM draft micro chamber test protocol.
3. Provide data and assist in drafting, revising and editing the internal EPA report. (Completion by July 29th).

Phase 2: August, September, (and beyond, depending upon availability of resources):

4. Conduct additional full-scale experiments that investigate the impact of ventilation on the time course of post application emissions.
5. Conduct experiments for additional product types (e.g., low pressure open cell two component SPF).
6. Assist EPA in integration of results into a revised EPA report and drafting manuscripts and/or a draft full-scale chamber emissions test protocol for consideration by ASTM-D22.05.

The contractor shall complete analysis of samples collected in micro chamber scouting tests to inform post application sampling volume recommendations for three low pressure medium density foam insulation materials furnished EPA within 30 days of approval of the QAPP. The contractor shall provide preliminary results of analyses of samples within 10 business days of completion of analyses of samples for each experiment.

If conducted in this work assignment period, the Contractor shall report results for the ASTM protocol evaluation testing within ten business days of completion of analyses of samples. The schedule for other testing and deliverables may be adjusted to accommodate the ACC/CPI foam production schedule.

The EPA will provide (1) test material information; (2) environmental data for each test. The Contractor shall provide (1) sampling information; (2) analytical data in excel files. These shall be submitted to the WACOR within 10 business days after completion of each test.

The Contractor shall provide the EPA WAM monthly progress reports as specified in the contract. The Contractor shall alert the WACOR in advance if they expect a substantial delay in completing any task or submitting a deliverable.

The Contractor shall provide necessary health and safety protocol and documentation.

ATTACHMENT #1 TO THE STATEMENT OF WORK (SOW)

FOR MEASUREMENT PROJECTS

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,

http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function; 07/14/08 A-2

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,

http://www.epa.gov/quality/qs-docs/r2-final.pdf

□ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X **QAPP Requirements for Measurement Projects**

□ **QAPP Requirements for Secondary Data Projects**

□ **QAPP Requirements for Research Model Development and/or Application Projects**

□ **QAPP Requirements for Software Development Projects**

□ **QAPP Requirements for Method Development Projects**

□ **QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/

EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.

1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.

2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.

3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.

3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.

4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.

4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.

4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.

4.5 Describe the method for uniquely numbering each sample.

4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5 MEASUREMENT PROCEDURES

5.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.

5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6 QUALITY METRICS (QA/QC CHECKS)

6.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

6.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7 DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

7.2 Describe data validation procedures used to ensure the reporting of accurate project data.

7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).

7.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

7.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

7.4 Describe data storage requirements for both hard copy and electronic data.

8 REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-013

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Ken Krebs
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-2850
FAX Number:

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Research Test House

WA #: 1-013 WACOR: Ken Krebs

Contract #: EP-C-15-008 Alternate WACOR:

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

The overall objective of this project is to develop, demonstrate, and evaluate sustainable practices for indoor environments. Sustainable practices are decisions and actions that consider, minimize, and harmonize the impact of materials and energy use on human health and the environment. Through integrated multidisciplinary and focused research, Indoor Environments Management Branch (IEMB) develops knowledge and tools that enable evaluation of sustainable practices for indoor environments. IEMB develops tools to characterize sources of indoor contaminants and investigates the relationships between sources of contaminants, the built environment and potential exposure to individual compounds and complex mixtures while considering the impacts of risk management solutions on building energy use. For example, IEMB investigates the impact of green building products on indoor air quality and develops risk management solutions where green building practices or products may potentially improve or impair indoor quality.

BACKGROUND

Rapidly increasing energy costs coupled with increasing market acceptance of "green" or sustainable residential building design has resulted in an increased demand for sustainable building practices and "green" building products. However, sustainable "green" building practices (e.g., super insulated, tight buildings constructed with recycled or "natural" products) may inadvertently result in degraded indoor environmental quality or other downstream environmental challenges. As a component of "cradle to cradle" stewardship of materials and energy, there is a need to understand the impacts on the indoor environment of: (1) emissions, sorption and re-emission of organic and inorganic compounds from "green" building materials; (2) transport within the built environment; and (3) efficacy of control technologies such as air and surface cleaning, and their affect on building energy use.

Key pollutants of concern include endocrine disrupting compounds such as brominated flame retardants, phthalates, and perfluorinated compounds associated with consumer products, neurotoxins such as elemental mercury released from the debris field of broken compact fluorescent light bulbs, and air toxics such as formaldehyde released and sorbed by some indoor materials and surfaces. Formaldehyde is one key toxic pollutant in the National Risk Management Research Laboratory (NRMRL) Indoor Air Strategic Plan. It is among the US Environmental Protection Agency (EPA) listed urban air hazardous air pollutants (HAPs) and one of the predominant VOCs emitted from building products. Primary emissions from materials and products as well as sorption and re-emission from surfaces are key factors that govern indoor concentrations.

There are three components of IEMB's research approach: (1) Develop source models that simulate emissions from green building products, (2) develop sorption/re-emission models for green building products, and (3) determine the reliability of source/sink models in full-scale indoor environments. The source emissions model parameters obtained from EPA's chamber tests will be applied to IAQ models to determine the impact of the use of "green" building design products on indoor concentrations of organic and inorganic contaminants. Source and sink models and control strategies will be evaluated by studies conducted in APPCD's Research Test House (RTH), operated by the contractor. Specific tasks and the schedule for tasks to be conducted in the RTH shall be described in amendments to this work assignment or described in other task-specific work assignments.

SCOPE

This project will require contractor staff with the following skills: modification and adaptation of scientific apparatus to meet project objectives, sample collection and extraction, data processing and analysis, preparation, operation and maintenance of the RTH.

TECHNICAL APROACH/OBJECTIVES

The contractor shall conduct the following tasks:

The contractor shall maintain the research test house in ready mode for model evaluation or other studies as described in amendments to this work assignment or described in separate work assignments that utilize the research test house. Specifically, the contractor shall ensure that all miscellaneous and standard operating procedures (MOPs and SOPs) are accurate and up to date for contractor operated measurement or control systems.

The contractor shall maintain the instrumentation in the RTH to ensure that the RTH can be utilized for specific research tasks within 30 days of notification through written amendments to this or other work assignments.

WA SPECIFIC EQUIPMENT

The RTH facilities will require installation and maintenance of environmental monitoring equipment. This monitoring equipment includes, but is not limited to, outdoor meteorological data and indoor temperature, pressure, and humidity.

QUALITY ASSURANCE

The contractor shall provide input to QA test plans, addendums, technical reports, and manuscripts developed by EPA staff for and from specific experiments to be conducted in the research test house. Data gathering/manipulation shall not begin until the QAPP has been approved by the EPA QA manager. The QA plan shall be developed according to the requirements in Attachment #1 to the Statement of Work. Environmental data collection cannot start until both APPCD and Contractor QA staff have received the completed signature page for the QAPP. Specific experiments, schedules and deliverables will be described in amendments to this work assignment.

All draft or revised QAPPs to be implemented by the Contractor that are submitted for APPCD QA approval must be accompanied by a signature page that is signed by the Contractor work assignment leader and Contractor QA officer to show that they have reviewed and approved the QAPP. Upon final approval of the QAPP, the APPCD work assignment manager and QA manager shall add their signatures to the signature page to show their review and approval.

DELIVERABLES

The contractor shall provide monthly reports of the RTH operational status. Reports and deliverables for other tasks, including new or revised MOPs or SOPs that are required to support QAPPs developed for specific research tasks to be conducted at the RTH, will be described in amendments to this work assignment.

SCHEDULE of DELIVERABLES

Reports on research activities and RTH facility status updates shall be delivered monthly.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-017

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017
Base Option Period Number 1

Title of Work Assignment/SF Site Name: WA 1-017

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name John Kinsey
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-4121
FAX Number:

Project Officer Name Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Novel Sampling Techniques for Measurement of Aircraft Volatile and Non-Volatile PM Emissions

WA #: 1-017 WACOR: John Kinsey

Contract #: EP-C-15-008 Alternate WACOR:

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

The overall objective of this project is to determine if total (volatile + non-volatile) particulate matter (PM) from aircraft turbine engines can be determined using one or more prototype dilution techniques as outlined below.

BACKGROUND

Aircraft PM is formed in the engine combustor due to incomplete combustion of fuel, and in the atmosphere through gas-to-particle transformations of organic and sulfur-based volatile components upon cooling and mixing with the atmosphere. PM emitted from the engine at exit temperatures and pressures are defined as non-volatile, whereas those formed via gas-to-particle conversion in the atmosphere downstream of the engine are known as volatile PM. Accurate measurement of non-volatile PM from aircraft engines is a daunting task due to the harsh environment found at the engine exit, particle losses during transport in the sample lines, and physical and chemical transformations of the sample as it is transported to analytical instrumentation. Reliable measurements of volatile PM are even more challenging as these are formed in the exhaust plume and are greatly influenced by ambient conditions and composition of the volatile species.

The Oak Ridge National Laboratory (ORNL)/Air Force Research Laboratory (AFRL)/University of Dayton Research Institute (UDRI) team has developed a unique dilution chamber (DC) system to homogeneously dilute and condition aircraft exhaust for the measurement of total (volatile + non-volatile) PM while sampling at the engine exit. In a separate effort, Aerodyne Research Inc. (ARI) has produced a condensation dilution probe (CDP) to effectively control the formation of volatile particles to simulate atmospheric processing behavior and to quantify this contribution on the total PM mass emissions. Both devices have shown excellent potential when tested in laboratory and limited field environments. Further demonstrations of these devices may lead to the development of more reliable

methodologies for the measurement of both volatile and non-volatile PM emissions from turbine engines at the engine exit.

The first demonstration test was conducted at Wright-Patterson Air Force Base (WPAFB) on a T-63 engine under a prior contract in September 2013. A second demonstration test using a C-17 aircraft was performed in June 2015. The goal of this Work Assignment (WA) will be to complete reporting of all results from the study.

SCOPE

The contractor shall assist the WACOR with final data analyses and reporting of results from the program. This work shall mainly include the results generated by the continuous emission monitoring equipment for gaseous pollutants but may include other parameters as well. In addition, as resources permit, the contractor shall also assist the WACOR with preparation of the project final report for both test campaigns including publications support. Additional background information will be provided to the contractor after initiation of the WA.

QUALITY ASSURANCE

The contractor shall develop quality assurance documentation as required in Appendix 1 to this Statement of Work. Work involving environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance staff. A new Quality Assurance Project Plan (QAPP) will be developed for the study including the work conducted under this Work Assignment. This QAPP will be based on a prior version prepared under EPA Contract EP-C-09-027, WA 6-78.

DELIVERABLES

The deliverables for this WA will consist of at least reduced data summaries and associated analyses. Other input to the final report shall also be prepared by the contractor, as necessary.

SCHEDULE of DELIVERABLES

The following deliverable will be provided to the WACOR:

- QA Summary Report for CEMs: April 22, 2016

ATTACHMENT #1 TO THE STATEMENT OF WORK (SOW) FOR MEASUREMENT PROJECTS

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD (mark all that apply):

X **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function;
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function; 07/14/08 A-2
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

□ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X **QAPP Requirements for Measurement Projects**

□ **QAPP Requirements for Secondary Data Projects**

□ **QAPP Requirements for Research Model Development and/or Application Projects**

□ **QAPP Requirements for Software Development Projects**

□ **QAPP Requirements for Method Development Projects**

□ **QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

---

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.
4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.
4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
4.5 Describe the method for uniquely numbering each sample.
4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5 MEASUREMENT PROCEDURES

5.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.
5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6 QUALITY METRICS (QA/QC CHECKS)

6.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.
6.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7 DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.
7.2 Describe data validation procedures used to ensure the reporting of accurate project data.
7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).
7.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.
7.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.
7.4 Describe data storage requirements for both hard copy and electronic data.

8 REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.
8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-019

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name John Kinsey
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-4121
FAX Number:

Project Officer Name Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Statement of Work

WA Title: PM/Air Toxics from Commercial Aircraft Engines

WA #: 1-019 WACOR: John Kinsey

Contract #: EP-C-15-008 Alternate WACOR:

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the date of receipt through March 31, 2017.

SUMMARY OF OBJECTIVES

The overall objective of this project is to characterize the particulate matter (PM) and air toxic emissions from commercial aircraft turbine engines.

BACKGROUND

A number of studies have been conducted by EPA over the past 12 years to characterize the PM and toxic air emissions from commercial aircraft engines. Two recent projects include:

- Black Carbon Instrument Comparison: This testing program evaluated four different methods for the determination of black carbon and elemental carbon using both a laboratory soot generator (Jing Mini-CAST) and aircraft turbine exhaust. A draft final report is available for the laboratory study and is undergoing peer review. The turbine measurements were conducted in September 2012 at Wright Patterson Air Force Base (WPAFB) on a T-63 turboshaft engine and the data were reduced and analyzed but never published. In addition, a new instrument (SuperMAAP) was produced under this project and further development is needed with respect to the LabView program used to operate the instrument and other possible "fixes."
- Variable Response in Aircraft nvPM (non-volatile particulate matter) Testing (VARIAnT): The purpose of this test campaign was to assess the source(s) of variability between multiple (and theoretically identical) prototype sampling systems measuring the emissions from the same source as determined in prior engine tests. Two campaigns were conducted at the University of TN Space Institute near the U. S. Air Force's Arnold Engineering Development Center (AEDC) in Tullahoma, TN. The data from these campaigns have been mostly reduced and analyzed. However, there are a number of outstanding instrument calibration issues found during VARIAnT 2 which still need to be addressed.

SCOPE

The contractor shall assist the WACOR with the following research:

- Task 1: The contractor shall provide technical support to the black carbon instrument validation program described above on an as-needed basis. As part of this support, the contractor may be asked to provide assistance to complete the final report for the laboratory study including production support as resources permit. The contractor may also be required to support preparation and submission of a draft journal article on the instrument comparison testing conducted in September 2012 at Wright Patterson Air Force Base. Other support may include: additional data analyses; responding to quality assurance and peer review comments, as needed; or additional work on the SuperMAAP instrument.

- Task 2: The most important task to be conducted under this WA shall be to provide continued technical support for the two campaigns conducted under the VARIAnT experimental program. This work shall include finalization and reporting of the experimental data as well as implementation of a new laboratory study to investigate mass instrument calibration issues. The latter activity shall involve the fabrication and assembly of a specialized system to evaluate the output from EPA's Mini-CAST soot generator using operational settings used during VARIAnT 2. The scope of this study is still evolving and will be shared with the contractor as soon as possible.

QUALITY ASSURANCE

The contractor shall develop quality assurance documentation as required in Appendix 1 to this Statement of Work. Work involving environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance staff. The VARIAnT 2 campaign was conducted under a Quality Assurance Project Plan (QAPP) developed under WA 0-019 (QTrak No. 15019/A21231) which will be used in this Work Assignment. A new QAPP will also be prepared for the laboratory calibration study.

DELIVERABLES

The deliverables for this WA will consist of at least:

1. Final results from VARIAnT 1 and 2.
2. Results from the laboratory instrument calibration study.

SCHEDULE of DELIVERABLES

The above deliverables shall be provided as follows:

1. VARIAnT 1 and 2 results: July 1, 2016
2. Calibration study results: October 1, 2016 (tentative)

ATTACHMENT #1 TO THE STATEMENT OF WORK (SOW) FOR MEASUREMENT PROJECTS

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD (mark all that apply):

X **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function;
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function; 07/14/08 A-2
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

□ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X **QAPP Requirements for Measurement Projects**

- ☐ **QAPP Requirements for Secondary Data Projects**
- ☐ **QAPP Requirements for Research Model Development and/or Application Projects**
- ☐ **QAPP Requirements for Software Development Projects**
- ☐ **QAPP Requirements for Method Development Projects**
- ☐ **QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

---

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.

4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.
4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.
4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
4.5 Describe the method for uniquely numbering each sample.
4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5 MEASUREMENT PROCEDURES

5.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.
5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6 QUALITY METRICS (QA/QC CHECKS)

6.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.
6.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7 DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.
7.2 Describe data validation procedures used to ensure the reporting of accurate project data.
7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).
7.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.
7.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.
7.4 Describe data storage requirements for both hard copy and electronic data.

8 REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.
8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-019

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2016

Base Option Period Number: 1

Title of Work Assignment/SF Site Name:

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2): ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Cost/Fee	LOE
Contract Period: 04/01/2015 To 03/31/2016		1,050
This Action:		0
Total:		1,050

Work Plan / Cost Estimate Approvals

	Cost/Fee	LOE
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: John Kinsey	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-4121
			FAX Number:
Project Officer Name: Robin Baily	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-7906
			FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code:
			Phone Number:
			FAX Number:
Contracting Official Name: Mark Cranley	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-487-2351
			FAX Number: 513-487-2109

Performance Statement of Work

WA Title: PM/Air Toxics from Commercial Aircraft Engines

WA #: 1-019. Amendment 1 WACOR: John Kinsey

Contract #: EP-C-15-008 Alternate WACOR:

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the date of receipt through March 31, 2017.

SUMMARY OF OBJECTIVES

The overall objective of this project is to characterize the particulate matter (PM) and air toxic emissions from commercial aircraft turbine engines

SCOPE

For the purpose of this amendment, the contractor shall perform the following new task:

- Task 3: It has been determined that assistance from an expert in aircraft emissions measurement is needed to analyze select particle size data from the VARIAnT 2 test campaign as it relates to particle losses in the sampling system. Therefore, the contractor shall provide the services of a suitable expert for this Work Assignment. This expert shall analyze the necessary particle size data provided by EPA and report the results of the analysis at a meeting of the SAE International E-31 Committee at its annual meeting in Toulouse, France.

DELIVERABLES

The deliverables for this Amendment will consist of:

1. Presentation for the SAE E-31 annual meeting in Toulouse, France

SCHEDULE of DELIVERABLES

The above deliverable shall be provided as follows:

1. Presentation will be given at the SAE E-31 meeting during the period of July 18 to 21, 2016 as specified by EPA.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-019

☐ Other ☒ Amendment Number: 000002

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2016 To 03/31/2017 Base Option Period Number 1	PM TOXICS PLANE

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: Section 1.2, 4, 6, & 7

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2016 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name John Kinsey (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-4121 FAX Number:
Project Officer Name Robin S. Harris (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-0955 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Candice Charlton (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2007 FAX Number:

Performance Statement of Work

WA Title: PM/Air Toxics from Commercial Aircraft Engines

WA #: 1-019, **Amendment 2** WACOR: John Kinsey

Contract #: EP-C-15-008 Alternate WACOR:

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the date of receipt through March 31, 2017.

SUMMARY OF OBJECTIVES

The overall objective of this project is to characterize the particulate matter (PM) and air toxic emissions from commercial aircraft turbine engines.

BACKGROUND

A number of studies have been conducted by EPA over the past 12 years to characterize the PM and toxic air emissions from commercial aircraft engines. Two recent projects include:

- Black Carbon Instrument Comparison: This testing program evaluated four different methods for the determination of black carbon and elemental carbon using both a laboratory soot generator (Jing Mini-CAST) and aircraft turbine exhaust. A draft final report is available for the laboratory study and is undergoing peer review. The turbine measurements were conducted in September 2012 at Wright Patterson Air Force Base (WPAFB) on a T-63 turboshaft engine and the data were reduced and analyzed but never published. In addition, a new instrument (SuperMAAP) was produced under this project and further development is needed with respect to the LabView program used to operate the instrument and other possible "fixes."
- Variable Response in Aircraft nvPM (non-volatile particulate matter) Testing (VARIAnT): The purpose of this test campaign was to assess the source(s) of variability between multiple (and theoretically identical) prototype sampling systems measuring the emissions from the same source as determined in prior engine tests. Two campaigns were conducted at the University of TN Space Institute near the U. S. Air Force's Arnold Engineering Development Center (AEDC) in Tullahoma, TN. The data from these campaigns have been mostly reduced and analyzed. However, there are a number of outstanding instrument calibration issues found during VARIAnT 2 which still need to be addressed.

SCOPE **(additional work and deletion shown in boldface type below)**

The contractor shall assist the WACOR with the following research:

- **Task 4: In this task, the contractor shall provide technical and production support for one or more reports and journal articles. This work shall include the final EPA Technical Report of the findings from the black carbon instrument validation covered in Task 1 as well as any others determined by the WACOR. Other support may include additional data analyses, responding to quality assurance and peer review comments, and word processing, as needed.**

- Task 1: The contractor shall provide technical support to the black carbon instrument validation program described above on an as-needed basis. As part of this support, the contractor may be asked to provide assistance to complete the final report for the laboratory study including production support as resources permit. The contractor may also be required to support preparation and submission of a draft journal article on the instrument comparison testing conducted in September 2012 at Wright Patterson Air Force Base. Other support may include: additional data analyses; responding to quality assurance and peer review comments, as needed; or additional work on the SuperMAAP instrument.

- Task 2: The most important task to be conducted under this WA shall be to provide continued technical support for the two campaigns conducted under the VARIAnT experimental program. This work shall include finalization and reporting of the experimental data as well as implementation of a new laboratory study to investigate mass instrument calibration issues. The latter activity shall involve the fabrication and assembly of a specialized system to evaluate the output from EPA's Mini-CAST soot generator using operational settings used during VARIAnT 2. The scope of this study is still evolving and will be shared with the contractor as soon as possible. **(Note that the laboratory study will not be done and is now removed from the Scope of the Work Assignment)**

- Task 3: It has been determined that assistance from an expert in aircraft emissions measurement is needed to analyze select particle size data from the VARIAnT 2 test campaign as it relates to particle losses in the sampling system. Therefore, the contractor shall provide the services of a suitable expert for this Work Assignment. This expert shall analyze the necessary particle size data provided by EPA and report the results of the analysis at a meeting of the SAE International E-31 Committee at its annual meeting in Toulouse, France.

QUALITY ASSURANCE

The contractor shall develop quality assurance documentation as required in Appendix 1 to this Statement of Work. Work involving environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance staff. The VARIAnT 2 campaign was conducted under a Quality Assurance Project Plan (QAPP) developed under WA 0-019 (QTrak No. 15019/A21231) which will be used in this Work Assignment. A **new QAPP** will also be prepared for the laboratory calibration study. **(now deleted)**

DELIVERABLES

The deliverables for this WA will consist of at least:

1. Final results from VARIAnT 1 and 2.
2. Results from the laboratory instrument calibration study **(deleted)**
3. Expert presentation for the SAE E-31 annual meeting in Toulouse, France
4. Final report for black carbon instrument validation

SCHEDULE of DELIVERABLES

The above deliverables shall be provided as follows:

1. VARIAnT 1 and 2 results: July 1, 2016
2. Calibration study results: October 1, 2016 (tentative) **[deleted]**
3. Presentation will be given at the SAE E-31 meeting during the period of July 18 to 21, 2016 as specified by EPA.
4. **Final black carbon instrument validation report at the conclusion of the management review process through STICS.**

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-020

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base X Option Period Number	

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2): ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name John Kinsey	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-4121 FAX Number:
Project Officer Name Robin Baily	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:
Other Agency Official Name	(Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Mark Cranley	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Biomass Pellet Emissions and Energy Efficiency

WA #: 1-020 WACOR: John Kinsey

Contract #: EP-C-15-008 Alternate WACOR: Tiffany Yelverton

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

The objectives of this project are to characterize the emissions and energy efficiency of an outdoor hydronic heater while burning two non-woody biomass fuels as compared to wood pellets.

BACKGROUND

Under a previous project, NRMRL characterized the emissions and energy efficiency of four outdoor wood-burning hydronic heaters as part of a Cooperative Research and Development Agreement (CRADA) with the New York State Energy Research and Development Authority (NYSERDA). As a follow-up to this research, NRMRL is in the process of conducting a similar study for the use of non-wood biomass fuels in a pellet-fired hydronic heater owned by Cornell University again using CRADA funding from NYSERDA. The purpose of this Work Assignment (WA) is to complete the CRADA-funded research which was started under EPA Contract No. EP-C-09-027 and WA 0-020 of this contract.

SCOPE

The contractor shall assist EPA in the performance of the research outlined in the approved Quality Assurance Project Plan (QAPP). The contractor shall perform the necessary testing, sample collection, and analyses for the study which includes all applicable measurements for emissions and appliance operation while burning the previously acquired pellet fuels in the Reka HKRST/V-FSK 20 hydronic heater installed outside of the High Bay building. Samples collected during each test shall also be transferred to the applicable EPA personnel for chemical analysis per the approved QAPP. Reduced data from all continuously monitored parameters shall also be provided by the contractor to the EPA WACOR for further analysis and inclusion in a final report. The work conducted shall be conducted in a similar

manner as that outlined in the prior hydronic heater testing performed for NYSERDA.[1]

QUALITY ASSURANCE

The contractor shall develop quality assurance documentation as required in Appendix 1 to this Statement of Work. Work involving environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance staff. A new Quality Assurance Project Plan (QAPP) was developed for the study in WA 0-020 including the work conducted under this Work Assignment. This QAPP was based on a prior version prepared under EPA Contract EP-C-09-027, WA 5-80.

DELIVERABLES

The deliverables for this WA will be final test results and other technical input to a final report.

SCHEDULE of DELIVERABLES

The following schedule shall be followed unless otherwise justified to the WACOR:

1. First test run: No later than 10 working days from issuance of the Work Assignment
2. Completion of experiments: June 1, 2016

[1] Gullett, B., R. Dodder, I Gilmour, M. Hays, J. Kinsey, W. Linak, D. Loughlin, L. Oudejans, T. Yelverton, G. Wood, M. Toney, A. Touati, J. Aurell, S-H. Cho, and S. Sidhu, "Environmental, Energy Market, and Health Characterization of Wood-Fired Hydronic Heater Technologies," Report No. 12-15, New York State Energy Research and Development Authority, Albany, NY (2012).

ATTACHMENT #1 TO THE STATEMENT OF WORK (SOW)

FOR MEASUREMENT PROJECTS

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD (mark all that apply):

☐ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function;
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

☐ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function; 07/14/08 A-2
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

☐ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X **QAPP Requirements for Measurement Projects**

□ **QAPP Requirements for Secondary Data Projects**

□ **QAPP Requirements for Research Model Development and/or Application Projects**

□ **QAPP Requirements for Software Development Projects**

□ **QAPP Requirements for Method Development Projects**

□ **QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

---

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.
4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.
4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
4.5 Describe the method for uniquely numbering each sample.
4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5 MEASUREMENT PROCEDURES

5.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.
5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6 QUALITY METRICS (QA/QC CHECKS)

6.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.
6.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7 DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.
7.2 Describe data validation procedures used to ensure the reporting of accurate project data.
7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).
7.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.
7.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.
7.4 Describe data storage requirements for both hard copy and electronic data.

8 REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.
8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-020

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2016

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name John Kinsey
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-4121
FAX Number:

Project Officer Name Robin S. Harris
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0955
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Statement of Work Amendment

WA Title: Biomass Pellet Emissions and Energy Efficiency

WA #: 1-020, Amendment 1 WACOR: John Kinsey

Contract #: EP-C-15-008 Alternate WACOR: Tiffany Yelverton

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (PWS) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

The objectives of this project are to characterize the emissions and energy efficiency of an outdoor hydronic heater while burning up to two non-woody biomass fuels as compared to wood pellets.

BACKGROUND

Under a previous project, NRMRL characterized the emissions and energy efficiency of four outdoor wood-burning hydronic heaters as part of a Cooperative Research and Development Agreement (CRADA) with the New York State Energy Research and Development Authority (NYSERDA). As a follow-up to this research, NRMRL is in the process of conducting a similar study for the use of non-wood biomass fuels in a pellet-fired hydronic heater owned by Cornell University. The purpose of this Work Assignment (WA) Amendment is to add funding and complete the necessary research.

SCOPE

The contractor shall assist EPA in the performance of the research outlined in the approved Quality Assurance Project Plan (QAPP) dated July 13, 2016. The contractor shall perform the necessary testing, sample collection, and analyses for the study which includes all applicable measurements for emissions and appliance efficiency while burning the previously acquired pellet fuels in the Reka HKRST/V-FSK 20 hydronic heater installed outside of the High Bay building. At least two fuel types (switchgrass and wood pellets) will be evaluated. Raw and summarized results of all applicable sample analyses and data from all continuously monitored parameters outlined in the QAPP shall be provided by the contractor to the EPA WACOR for inclusion in the final report. The data submitted shall be in the form of applicable tables, graphs or appropriate narratives of contractor collected results.

DELIVERABLES

The deliverables for this WA will be technical input to the final report plus report production support.

SCHEDULE of DELIVERABLES

The following schedule shall be followed unless otherwise justified to the WACOR:

1. Completion of all experiments: November 15, 2016
2. Completion of input to final report: February 15, 2017

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-021

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017
Base X Option Period Number

Title of Work Assignment/SF Site Name: 1-021

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 1, 4, 6

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance
From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Eben Thoma
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7969
FAX Number:

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Fenceline, Fugitive, and Area Source Emissions Measurements and Methods

WA #: 1-021 WACOR: Eben Thoma

Contract #: EP-C-15-008 Alternate WACOR:

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance of Work Statement shall be from the time of the award through March 31, 2017.

SUMMARY OF OBJECTIVES

This work assignment (WA) continues research efforts in the fenceline, fugitive, and area source emissions measurement topic area. The goal of this WA is to continue development of select aspects of these technologies, demonstrate them in the field where possible, and document them through method development activities.

BACKGROUND

Reducing fugitive and area source emissions of greenhouse gases (GHGs), hazardous air pollutants (HAPs), other volatile organic compounds (VOCs), and certain inorganic gases from industrial facilities, agricultural operations, energy production, and waste disposal, is an ongoing priority for EPA and our state and local co-regulators. Unlike stack emissions, fugitive and area source releases are difficult to detect and measure, due to the spatial extent and inherent temporal variability of the potential sources.

Fenceline, process, and control system monitoring using new technical approaches (e.g. optical remote sensing (ORS), infrared cameras, hyper spectral imaging, mobile measurements, passive sampler and sensor network techniques) can augment manual leak detection and repair LDAR programs (where they exist) by providing spatially-resolved, speciated, and/or near real-time emissions information. Time-integrated passive sampling is also an important emerging screening approach (reference draft method 325A and B). The detection of fugitive emission by time-resolved monitors, coupled with wind direction data, can be used to pinpoint and repair fugitive leaks with short response times, greatly decreasing the potential for emissions.

Background information on this WA can be found in QAPPs and related products associated EP-C-15-008, WA 0-21. Additional background information on the primary study site involving passive samplers and sensors, reference EPA QAPP for Philadelphia Passive Sampler and Sensor Study under NRMRL QLOG No. A-18508, QTRAK No. 13010, and NERL QAPP "Collaborative Evaluation/Validation of a Low-Cost Volatile Organic Compound Passive Sampling Method" and associated 2015 and 2016 AWMA conference papers to be provided.

SCOPE

The contractor shall prepare a work plan (WP) that includes individual itemized cost and LOE estimates for each task set including anticipated other direct cost (ODC) components (e.g. subcontract, travel, laboratory analysis, equipment rental, etc.). The contractor shall track expenditures for each task and update in monthly reports.

The contractor shall coordinate with EPA team members and outside collaborators for this project. The contractor shall be responsible for coordinating with the identified sites (or companies or facilities) regarding on-site work performed by the contractor (or potential subcontractors). The contractor shall prepare site-specific safety plans meeting the requirements of the site. The contractor shall receive and document approval for the site safety plan prior to on-site work.

No confidential business information shall be discussed or recorded as part of any information gathering activity as part of this project. Any digital photographs or OGI videos documenting PC configurations shall authorized by the site (or company or facility).

For the tasks described subsequently, the contactor shall make the following scope assumptions:

Task 1.1: Duration of field study 6-months (unmanned).

Task 1.2: Duration of field study 4 days.

Task 2.0: The contractor shall assume RM Young 2-D sonic anemometers for this build.

Task 3.0: The contractor shall assume 1.0 man-day per week on average for operation of the range with consumables including calibration gas supplies not to exceed $5000.

Task 4.0: This is a continuation of work from WA 0-21 so scope should be understood.

Task 5.0: The contractor shall assume a 6-month deployment (unmanned) with equipment lease costs. No infrastructure costs shall be anticipated.

TECHNICAL APROACH/OBJECTIVES

Under the technical direction of the EPA work assignment manager (WAM), the contractor shall execute the tasks listed below. The contractor shall assume bi-weekly meetings and conference calls to review progress with the WAM and EPA collaborating groups related to these efforts. Meeting frequency in the planning phases of the projects shall be greater. The contractor shall evaluate the potential need for outside consultants and/or laboratories with expertise in the various technical areas to meet deliverables and shall be responsible for defining, executing, and managing any subcontracts that may be required. The contractor shall be responsible for arranging and executing any required equipment rentals, site access agreements, and related infrastructure needs (e.g. trailer and equipment transport, land power drop, permits, etc.) as part of the execution of any field campaigns or evaluations. The contactor shall be responsible for all safety and health coordination for any field or laboratory operations.

QUALITY ASSURANCE

Work involving collection of environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff. The Quality Assurance Project Plans (QAPPs) associated with these tasks shall be at a Category B level (unless otherwise specified) and must include all necessary elements as described in the referenced documentation (See Attachment 1).

All QAPPs and QAPP addendums shall be reviewed and approved by the contractor's WA leader and QA officer. Once it has obtained their approval, it shall be submitted to the EPA QA staff for review and approval. It shall be accompanied by a signature page that is signed by the contractor's WA leader and QA officer to show that they have reviewed and approved the QAPP. It is the responsibility of the contractor's WA leader to document this process. Upon receipt of the signed QAPP, the EPA WA manager and QA manager will review and approve the QAPP and they will add their signatures to the signature page. For work involving analysis by outside laboratories, the contractor shall review and document all subcontractor quality management plan information as per current contract and EPA QA policy requirements.

DELIVERABLES

For all data analysis and reporting deliverables, the contractor shall provide materials in Microsoft Word™ and Excel™ formats along with all raw and processed files or videos for the provided data in native formats unless otherwise specified.

All deliverables are due before March 31, 2017 unless otherwise noted.

Task 1: Philadelphia field tests and data analysis

Under the technical direction of the WAM and in consultation with other collaborators, the contractor shall plan and execute the following subtasks associated with the Philadelphia projects:

Task 1.1: SPod/Sentinel network deployment

The contractor shall complete fabrication, testing, and quality assurance documentation of a SPod/Sentinel network consisting of three solar powered SPods and one Sentinel Base Station. The contractor shall complete the QAPP for the deployment of this network in south Philadelphia at the agreed-upon locations (TBD). The contractor shall execute the deployment, acquire and store field and QA data products, and provide this information to the EPA WAM on a monthly basis as a short-from report. The monthly short-from report shall include any notable issues and corrective actions taken to maintain operation. The contractor shall decommission the deployment and return all equipment to RTP prior March 31, 2017. No contractor long-form report is required for this project.

Deliverables: Preparation for and initiation of field deployment before July 29, 2016. Short-form data reports delivered by the last business data of each calendar month during deployment. Decommission and return equipment to RTP before March 31, 2017.

Task 1.2: Philadelphia AMS UV DOAS testing and data analysis

The contractor shall execute in-field calibration testing of the Philadelphia Air Measurement Services (AMS) open-path UV spectroscopy systems as per existing (approved) QAPP and provide results in a short-form data report. The contractor shall construct an SOP for reprocessing the open-path UV spectroscopy data gathered by AMS using the best available analysis

approach. The SOP shall be reviewed and approved by EPA QA. The contractor shall reanalyze the AMS data and provide results in a short-from data report and analysis package.

Deliverables: Execution of calibration test by July 29, 2016. Preparation for and initiation of data analysis activities by May 27, 2016. Completion of data analysis and delivery of short-form report by September 30, 2016.

Task 2: Development of second SPod/Sentinel network

The contractor shall complete fabrication, testing, and quality assurance documentation of a SPod/Sentinel network consisting of three solar powered SPods and one Sentinel Base Station.

Deliverables: Completion of builds, QA documentation, and pre-deployment testing before July 29, 2016.

Task 3: Operation of ORS test range and demonstrations

The contractor shall safety operate the ORS test range on an as needed basis as indicated by technical direction of the WAM. The contractor shall work with one or more vendors to develop, document, and execute short-term demonstrations of early version fenceline optical remote sensing, sensor, and/or gas chromatograph (GC) technologies GC technologies. The contactor shall prepare appropriate quality assurance documentation of these activities which may occur at multiple field locations. No tests shall be conducted until EPA ORD has approved the demonstration protocol or QAPP Addendum.

Deliverables: Execution and QA documentation of ORS test range or field demonstration upon receipt of technical direction. No work shall commence until proper QA documentation is approved. Delivery of short-form data summary within 30 calendar days of completion of test or prior to March 31, 2017.

Task 4: Development of a report on open-path UV spectroscopy for refinery fenceline measurements of benzene.

Continuing efforts from WA 0-21, and using input from independent technical experts in the topic area (as required), the contractor shall develop an EPA report on the state of the science on open-path ultraviolet spectroscopy for refinery fenceline monitoring applications. The report shall include a definition of and analysis approaches for determination of method

detection limits, quantitation limits, and the spectral interference and noise-limited factors that affect these limits. These detection limit analyses shall be based on real-world finite-width plume detection scenarios (not on length-extrapolated homogenous concentration calculations). The report shall include quality assurance metrics for real-time detection limit verification and in-field operational verification procedures. The report shall also include a summary of commercially available instruments and analysis of the full implementation and maintenance costs (ranges) for these technologies. The report shall include recommendations for in field (real optical path) quality assurance testing procedures including both functional optical cell (flow-through)-based approaches and post-acquisition spectral analysis approaches, including projected costs for these procedures.

Deliverables: A draft version of the report shall in proper EPA format including all supporting fata shall be delivered by Sept 30, 2016.

Task 5: California field tests and data analysis

Under the technical direction of the WAM and in coordination with California Agencies, industry collaborators, and instrument vendors, the contractor shall plan and potentially execute one or more long-term fenceline technology field demonstration projects in 2016 and report results. The first project shall involve a deployment of UV optical remote sensing in a refinery in the San Francisco Bay Area. The contractor shall participate in group calls to establish the feasibility, strategy, length, and cost of a coordinated deployment. The contractor shall prepare a deployment plan for review by the EPA WAM. A decision to proceed with the deployment will be provided as technical direction to the contractor. Upon receipt of technical direction, the contractor shall prepare a QAPP for the project and execute all planning and preparation details. After approval of the QAPP, the contractor shall execute the project. The contractor shall execute the deployment, acquire and store field and QA data products, and provide this information to the EPA WAM on a monthly basis as a short-from report. The monthly short-from report shall include any notable issues and corrective actions taken to maintain operation. The contractor shall decommission the deployment and return all equipment to RTP prior March 31, 2017. No contractor long-form report is required for this project.

Deliverables: Preparation for and potential initiation of field deployment before July 29, 2017. Short-form data reports delivered by the last business data of each calendar month during deployment. Decommission and return equipment to RTP before March 31, 2017.

SCHEDULE of DELIVERABLES

See previous sections for deliverable due dates.

All deliverables are due before March 31, 2017 unless otherwise specified.

ATTACHMENT #1
TO THE STATEMENT OF WORK (SOW)

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD:

☐ **NRMRL=s Quality System Specifications:**

(1) a description of the organization=s Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization=s general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

☐ **NRMRL=s Quality System Specifications:**

(1) a description of the organization=s Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization=s general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

☐ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X **QAPP Requirements for Measurement Projects**

X **QAPP Requirements for Secondary Data Projects**

☐ **QAPP Requirements for Research Model Development and Application Projects**

☐ **QAPP Requirements for Software Development Projects**

X **QAPP Requirements for Method Development Projects**

☐ **QAPP Requirements for Design, Construction, and Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS: Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.

4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.

4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.

4.5 Describe the method for uniquely numbering each sample.

4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5. MEASUREMENT PROCEDURES

5.1. Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.

5.2. If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6. QUALITY METRICS (QA/QC CHECKS)

6.1. For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

6.2. Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

7.2 Describe data validation procedures used to ensure the reporting of accurate project data.

7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).

7.3.1 If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

7.3.2 If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

7.4 Describe data storage requirements for both hard copy and electronic data.

8. REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-021

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2016 Base Option Period Number 1	1-021

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:
Adding Alternate COR and amending base

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2016 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee — LOE:

Cumulative Approved: — Cost/Fee — LOE:

Work Assignment Manager Name: Eben Thoma (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7969 FAX Number:	
Project Officer Name: Robin Baily (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:	
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:	
Contracting Official Name: Mark Cranley (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109	

WA 1-021 Amendment 1: Add task #6 to WA 1-021 for JTI EP-C-15-008

Task #6 Development of Other Test Methods:

Under the technical direction of the WAM and in coordination with industry collaborators, the contractor shall develop two Other Test Methods (OTM). The OTMs shall be written using the Environmental Monitoring Management Council Methods Format.

OTM 33B will provide a methodology for the use of tracer correlation to determine emissions mass rate emissions from a stationary source. The methodology should encompass the large variety of sources and applications that are viable candidates for this approach such as near field point release such as an isolated tank battery or far field large physical area sources such as landfills. The methodology should account for the current state of science and method evaluation and development done by, but not limited to, EPA, Waste Management, Aerodyne, Fluxsense, and Chalmers University. As much as possible, the method shall be written such that data quantity indicators are performance based and do not limit the measurement to a specific measurement technology. The method shall also include an annex with reference to the potential tracer gases and their pros and cons.

OTM 33C shall provide a methodology for the use of solar occultation flux(SOF) for location and quantification of emissions mass rate from a stationary sources. This methodology may be written in a technology specific format. This method shall cover both near and far field measurements of small isolated sources or large industrial complexes using SOF. The method shall cover all the data quality indicators listed, but limited to, for the solar tracking, spectra acquisition, reference spectra, use of synthetic and dynamic background, quantification algorithms, detection capabilities of the total system, and wind measurements. The method may reference voluntary consensus standards, when applicable.

Deliverables and Schedule:

D1: After approval of the revised work plan, the contractor shall conduct monthly calls on the status of the OTMs.

D2: Two months after the approval of the WP, the contractor shall submit a draft outline of both OTM 33B and 33C.

D3: Each month after the submission of the outline of the OTM, the contractor shall submit the working drafts of both methods. The contractor shall incorporate the comments received during the working draft stage under the technical direction of the WAM.

D4: Six months after the approval of the WP, the contractor shall deliver the final working draft on one of the methods to EPA for comments.

D5: Nine months after the approval of the WP, the contractor shall deliver the final working draft of the other method.

D6: The contractor shall revise and finalize the draft methods within one month receipt of the EPA comments and deliver the revised drafts of both methods before March 31, 2017.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-021

☐ Other ☒ Amendment Number: 000002

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee — LOE:

Cumulative Approved: — Cost/Fee — LOE:

Work Assignment Manager Name: Eben Thoma
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7969
FAX Number:

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name:
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

WA 1-021 Amendment 2: Add Task #7 and #8 to WA 1-021 for JTI EP-C-15-008

The contractor shall produce separate cost estimates for Tasks #7 and #8 in the revised work plan.

Task #7 Testing of EPA prototype SOF system:

Under the technical direction of the WAM and in coordination with EPA collaborators and external parties, the contractor shall execute and document a comparison performance test and further method development activates of the newly-developed EPA prototype solar occultation flux (SOF) system. Information regarding the EPA SOF system and a preliminary performance test was developed under another EPA contract in early 2016. The quality assurance project plan (QAPP) and the draft report from this previous work will be provided to the contractor as background information. Currently, the EPA SOF system is under construction as part of a separate EPA procurement activity and will be available for use starting in September 2016. The contractor shall develop a QAPP describing the testing and method development activities for this Task and this QAPP shall be approved prior to execution of testing. The testing and method development activities shall include:

- Evaluation and documentation of the performance of the EPA SOF system
- Comparison testing of the EPA SOF system to another U.S. based SOF system
- Investigation of alternate data processing approaches for EPA SOF system
- Execution of a field test for ammonia (NH_3) from animal feed lots using the EPA and other U.S. SOF systems
- Documentation of testing results and QA procedures and operating procedures

Deliverables and Schedule:

D1: After approval of the revised work plan, the contractor shall conduct monthly calls on the status of the Task with EPA collaborators and external parties.

D2: Within two months after the approval of the WP, the contractor shall complete the QAPP for the project.

D3: The contractor shall complete all testing and documentation and deliver to EPA before March 31, 2017.

Task #8 Quantitative Optical Gas Imaging Testing and Method Development:

Under the technical direction of the WAM and in coordination with EPA collaborators and external parties, the contractor shall execute and document performance testing and further method development activates of for select Quantitative Optical Gas Imaging (QOGI) approaches. Information regarding QOGI preliminary performance test was developed under another EPA project in 2015 and also as part of WA 1-37. The quality assurance project plan (QAPP) and the draft report from this previous work will be provided to the contractor as background information. The contractor shall

develop a QAPP describing the testing and method development activities for this Task and this QAPP shall be approved prior to execution of testing. The testing and method development activities shall include:

- Evaluation and documentation of the performance of the one or more QOGI systems
- Controlled release validation testing of QOGI systems using multiple compounds
- Documentation of testing results and QA procedures and operating procedures

Deliverables and Schedule:

D1: After approval of the revised work plan, the contractor shall conduct monthly calls on the status of the Task with EPA collaborators and external parties.

D2: Within three months after the approval of the WP, the contractor shall complete the QAPP for the project.

D3: The contractor shall complete all testing and documentation and deliver to EPA before March 31, 2017.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-022

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base X Option Period Number	Raleigh Multi-Pollutant Site

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Sue Kimbrough (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-2612 FAX Number:	
Project Officer Name Robin Baily (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:	
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:	
Contracting Official Name Mark Cranley (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109	

STATEMENT OF WORK

TABLE OF CONTENTS

1 TITLE: 2

2 DATE: 2

3 BACKGROUND 2

4 APPLICABLE, CONTROLLING DOCUMENTS AND WEB SITES: 3

5 TECHNICAL REQUIREMENTS/TASK DESCRIPTION: 4

5.1 Raleigh Near-Road site 4

5.1.1 Study Site/City Site 4

5.1.1.1 Site Infrastructure 4

5.1.1.2 Training Activities 5

5.1.1.3 Field Deployment 5

5.1.2 Commencement of Site Operations 5

5.1.2.1 Pollutants of Interest 5

5.1.2.2 Meteorological Instrumentation 6

5.1.2.3 Other Instrumentation/analyzers. 6

5.1.2.4 Data Completeness 6

5.1.2.5 Maintenance of Equipment 7

5.1.2.6 Supplies and Other Miscellaneous Equipment 7

5.1.3 Traffic Monitoring and Vehicle Classification 7

5.1.3.1 Statistical Analysis 8

5.2 Quality Assurance Project Plan (QAPP) 8

5.3 Safety Plan 8

5.4 Project Reports 8

6 DEFINITIONS: 8

7 REPORTING REQUIREMENTS 9

8 SPECIAL TERMS AND CONDITIONS 10

1 **TITLE:** Raleigh Multi-Pollutant Site

2 **DATE:** April 1, 2016 PoP: Award through March 31,2017.

3 BACKGROUND

EPA in collaboration with the Federal Highway Administration (FHWA) has conducted two long-term near-road studies in Las Vegas, NV and Detroit, MI. The Las Vegas study was completed in March, 2010 and the Detroit study was completed in June, 2011. A principal driver behind these studies was a Settlement Agreement between FHWA and Sierra Club to perform near-road air pollution studies.

On January 22, 2010, EPA strengthened the health-based National Ambient Air Quality Standard (NAAQS) for nitrogen dioxide (NO_2). To determine compliance with the new standard, EPA established new ambient air monitoring and reporting requirements for NO_2. At least one monitor must be located near a major road in any urban area with a population greater than or equal to 500,000 people. Raleigh, NC is such an urban area.

For the study covered by this SOW, EPA will be collaborating with the North Carolina Department of Environment and Natural Resources' (NCDENR) Air Quality Division and FHWA regarding a near-road air pollution study. This collaboration leverages resources of all three agencies with regards to establishing a long-term study site for EPA's near-road research program and interest in air pollution control strategies and exposure assessment, a long-term near road NO_2 monitoring site for NCDENR, and a long-term near-road site for FHWA's interest in identifying effective strategies for mitigating air pollution from transportation sources.

The Raleigh Near-Road site will function as a multi-pollutant measurement research site that will include (but not limited to) NO, NO_2, NO_X, CO, BC, mobile source air toxics (MSATs), particulate ($PM_{2.5}$), ultrafine particulate, etc. The objective of the research study is to determine mobile source air pollution concentrations and variations in concentrations as a function of distance from the highway and to establish relationships between mobile source air pollution concentrations as related to highway traffic flows including traffic count, vehicle types and speeds; and meteorological conditions such as wind speed and wind direction. As such, the

Raleigh Near-Road study would be expected to provide data detailing concentrations and distributions of motor vehicle emitted pollutants including regulated gases, air toxics, and particulate matter. Specifically, the data will be used to address the following goals:

1. Identify the existence and extent of elevated air pollutants near roads.
2. Determine how vehicle operations and local meteorology influence near road air quality for regulated and air toxic pollutants.
3. Collect data that will be useful in evaluating and refining, if necessary, models used to determine the emissions and dispersion of motor vehicle related pollutants near roadways.

The following site is currently selected and measurements are underway:

1. Raleigh, NC

4 APPLICABLE, CONTROLLING DOCUMENTS AND WEB SITES:

"Monitoring Protocol", Attachment A to this document (previously provided under EP-C-15-008, WA 0-22); Also located at this URL: http://www.fhwa.dot.gov/environment/air_quality/air_toxics/research_and_analysis/near_road_study/

FHWA's The National Near Roadway MSAT Study Web Page -- http://www.fhwa.dot.gov/environment/airtoxicmsat/

Office of Environmental Information. ***EPA Requirements for Quality Assurance Project Plans***, EPA QA/R-5, EPA/240/B-01/003, U.S. Environmental Protection Agency. March 2001. http://www.epa.gov/quality/qs-docs/r5-final.pdf.

Office of Environmental Information. ***Guidance for Quality Assurance Project Plans*** (QA/G-5), EPA /240/R-02/009, U.S. Environmental Protection Agency. December 2002, http://www.epa.gov/quality/qs-docs/g5-final.pdf.

5 TECHNICAL REQUIREMENTS/TASK DESCRIPTION:

The technical basis for this effort will be the "Monitoring Protocol" – Attachment A. The contractor shall perform the Monitoring Protocol as described in Attachment A of this document (previously provided under EP-C-15-008, WA 0-22). The contractor shall propose alternative methods/approaches that may yield cost-savings over the life of the project. These alternative methods/approaches should be construed as encompassing all aspects of the project.

Before this work is initiated the contractor shall meet with the EPA researchers to ensure that the objectives of this project and the resource boundaries are understood.

5.1 Raleigh Near-Road site

5.1.1 Study Site/City Site

The near-road study site was selected in collaboration with North Carolina DENR Air Quality Division staff. Throughout the rest of this SOW the site will be referenced as the Raleigh Near-Road site or Triple Oak site.

The terms "location" and "site" shall be interpreted to include the AIRS site [(site on EPA campus behind the National Computer Center (NCC)] as well as the Triple Oak site that will be operated for the duration of this study as required by the specific needs of this project. A GoogleMaps image of the site is provided as Attachment B.

5.1.1.1 Site Infrastructure

The contractor shall be responsible for negotiating and maintaining all of the necessary leasing, site operation permits, electrical connections, security/insurance arrangements to operate this site for the duration of the study as required by the specific needs of this project. The contractor shall be responsible for maintaining (including but not limited to) shelter condition/integrity and HVAC operations. The contractor shall be responsible for payment of electricity and communication (data and phone) costs incurred at the Raleigh air monitoring sites. The contractor shall be responsible for ensuring appropriate calibration gases are made available for the duration of the study as required by the specific needs of this project.

5.1.1.2 Training Activities

The contactor shall be responsible for arranging training on equipment as required by the specific needs of this project. This training would include analyzers, data loggers and data logging software. While instruments concepts are similar among the same instrument types, actual instrument operations may differ significantly between different vendors. Thus training is needed to understand specific instrument, data loggers and software utilized by this project.

5.1.1.3 Field Deployment

5.1.2 Commencement of Site Operations

Site operations commenced during a previous work assignment (EP-C-09-027, Opt. 4, WA-22) and continued during (EP-C-09-027, Opt. 6, WA-22 and EP-C-15-008, WA 0-22). Remote monitoring of instrumentation will be performed by EPA staff at the RTP Facility utilizing a PC running WinAQMS/Airodis. When instrument performance issues occur, a site operator will be dispatched on an as needed basis and as resources permit.

5.1.2.1 Pollutants of Interest

The contractor shall collect monitoring data for the pollutants of interest as required by the specific needs of this study. The pollutants of interest are as follows:

Pollutant	Surrogate Species	Monitoring Method	Frequency	Sampling Period	Samples / Sampling Frequency	Samples/Year
Sulfur Dioxide		Ecotech 9850	Continuous	Continuous	Continuous	Continuous
Carbon Dioxide		LI-COR	Continuous	Continuous	Continuous	Continuous
Ozone		Ecotech 9810	continuous	continuous	continuous	continuous
Nitrogen Dioxide		Aerodyne CAPS NO_2	continuous	continuous	continuous	continuous
Particle No.		TSI CPC 3783	continuous	continuous	continuous	continuous
Ultrafines		TSI 3031	Continuous	Continuous	Continuous	Continuous
Diesel Particulate Matter	Carbon Monoxide	Ecotech 9830	Continuous	Continuous	Continuous	Continuous
	Nitrogen Oxides	Ecotech 9841			Continuous	Continuous
	Black Carbon	Aethalometer			Continuous	Continuous
	$PM_{2.5}$	SHARP	Continuous	Continuous	Continuous	Continuous

Pollutant	Surrogate Species	Monitoring Method	Frequency	Sampling Period	Samples / Sampling Frequency	Samples/Year
1,3-butadiene, benzene (including other btex compounds)		Continuous	Continuous	Continuous	Continuous	Continuous
Wavetronix (traffic counts)		Radar	Continuous	Continuous	Continuous	Continuous

5.1.2.2 Meteorological Instrumentation

The contractor shall provide logistical support with regards to the operation of the following suite of meteorological instrumentation: 3-D sonic anemometer, temperature probe, relative humidity sensor, solar radiation sensor, barometric pressure sensor, and rain gauge. The contractor shall assist with the operation and trouble-shooting of these instruments on an as needed basis and as identified by the WACOR.

5.1.2.3 Other Instrumentation/analyzers.

The contractor shall assist with the operation and calibration on an as needed basis the following instruments: two Chromatotec semi-continuous GCs. The contractor shall assist with the installation, operation and calibration of an Aerodyne CAPS NO_2 instrument. The contractor shall assist with the installation, operation, calibration and trouble-shooting of other instruments/analyzers that may be identified by the WACOR as needed for the Raleigh Near-Road Multi-Pollutant site.

5.1.2.4 Data Completeness

The contractor shall collect monitoring data with completeness criteria as shown in the table below and as required by the specific needs of this study.

Pollutant	Sampling Approach	Accuracy	Precision	Data Completeness
Sulfur dioxide	Continuous monitoring UV fluorescence	20%	10%	80%
Carbon dioxide	non-dispersive infrared	20%	10%	80%
Carbon monoxide	Continuous monitoring (NDIR FRM CO analyzer)	20%	10%	80%
Nitrogen oxides	Continuous monitoring (Chemiluminescence NOx analyzer)	20%	10%	80%
Ozone	Continuous monitoring UV photometry	20%	10%	80%

Pollutant	Sampling Approach	Accuracy	Precision	Data Completeness
NO2	Continuous monitoring Optical absorption spectrometer	20%	10%	80%
Black carbon (surrogate - diesel)	Continuous monitoring (Aethalometer)	5%	5%	80%
$PM_{2.5}$	Continuous monitoring (SHARP)	20%	10%	80%
Ultrafines	Continuous monitoring (TSI)	20%	10%	80%
Particle No.	Continuous monitoring (TSI)	20%	10%	80%
$PM_{2.5}$	Integrated filter sampling ($PM_{2.5}$ FRM method)	20%	10%	90%
	Continuous GC			
Benzene (MSAT)	Continuous GC	10%	5%	80%
1,3-Butadiene (MSAT)		10%	5%	80%
Other BTEX compounds		10%	5%	80%

5.1.2.5 Maintenance of Equipment

The contractor shall be responsible for the proper maintenance of equipment as required by the needs of this study.

5.1.2.6 Supplies and Other Miscellaneous Equipment

The contractor shall purchase or otherwise have available any additional miscellaneous equipment or supplies that may be needed for successful completion of this effort. The contractor shall consult with the EPA WAM and other EPA technical representatives prior to purchasing items in excess of $2,000.

The contractor shall lease or purchase as needed the required supplies such as calibration gases and other miscellaneous equipment not already specifically identified as required by the needs of this study.

5.1.3 Traffic Monitoring and Vehicle Classification

Traffic data is being collected by US EPA utilizing a Wavetroix radar unit (SmartSensor HD).

5.1.3.1 Statistical Analysis

The contractor shall provide logistical support for (but is not limited to) the preparation of tables, graphs, text, etc. that would be used to create report(s) as required by the needs of this study. The results of statistical analyses or other relevant calculations shall be provided to the EPA WAM in the required QA/QC audit reports, quarterly data reports and a final report as required by the specific needs of this study. The contractor shall consult with the EPA WAM and other EPA technical representatives on the nature of the statistical software prior to implementation.

5.2 Quality Assurance Project Plan (QAPP)

The contractor shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form" and the NRMRL QA Requirements/Definitions List included with this effort. The work to be performed falls under the QA requirements for "**Measurement**" projects, Category III. See http://intranet.epa.gov/nrmintra/lsas/eqmp/pdf/MeasurementQAPPNRMRLrev0.pdf. WACOR will prepare a new QAPP with input from the contractor. A previously approved QAPP will be supplied to the contractor (QAPP QTRAK # is 07035-A12395). The QAPP is a "living document" and as such may require modifications as required by the needs of this study. The contractor shall provide input and revisions to the QAPP as required by the needs of this study.

5.3 Safety Plan

The contractor shall prepare or revise as necessary a Safety Plan. A Safety Plan was previously developed under Contract EP-C-15-008, WA 0-22.

5.4 Project Reports

The contractor shall provide monthly reports as required by the specific needs of this study. Section 8 of the Monitoring Protocol (Attachment A) contains the relevant details.

6 DEFINITIONS:

Air Monitoring Station -- Air monitoring stations are shelters containing the air sampling instrumentation including the meteorological instrumentation, data logging hardware, software, communications and any other equipment and supplies as required by the specific needs of the *FHWA Detailed Monitoring Protocol*. For this project, air monitoring stations may be standard utility trailers or converted shipping containers.

7 REPORTING REQUIREMENTS

1. The EPA WAM and other EPA technical representatives will develop a new QAPP for this task. A previously approved QAPP will be supplied to the contractor (QAPP QTRAK # is 07035-A12395). The QAPP is a "living document" and as such may require modifications as required by the needs of this study. The contractor shall provide input and revisions to the QAPP as required by the needs of this study. The specific details of the required QAPP are discussed in a previous section of this SOW.

2. The contractor shall schedule monthly conference calls with the EPA WAM during which task progress and issues will be discussed. The contractor shall summarize the notes from each of these conference calls in the form of an e-mail message to the EPA WAM.

3. The contractor shall provide monthly reports as required by the specific needs of this study. Section 8 of the Monitoring Protocol contains the relevant details.

DELIVERABLES

1. The EPA WAM and other EPA technical representatives will develop a new QAPP for this task. A previously approved QAPP will be supplied to the contractor (QAPP QTRAK # is 07035-A12395). The QAPP is a "living document" and as such may require modifications as required by the needs of this study. The contractor shall provide input and revisions to the QAPP as required by the needs of this study. The specific details of the required QAPP are discussed in a previous section of this SOW. The specific details of the required QAPP are discussed in a Section 5.2 of this SOW. This QAPP shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form" and the NRMRL QA Requirements/Definitions List included with this effort. The work to be performed falls under the QA requirements for "**Measurement**" projects, Category III. See ***EPA Requirements for Quality Assurance Project Plans***, EPA QA/R-5, EPA/240/B-01/003, March 2001, http://www.epa.gov/quality/qs-docs/r5-final.pdf. Additional guidance with regards to measurement QAPP requirements may be found in Chapter 2 of the Guidance for Quality Assurance Project Plans (QA/G-5), EPA /240/R-02/009, December 2002,

http://www.epa.gov/quality/qs-docs/g5-final.pdf. This QA/QC plan shall be provided to the EPA WAM in an MS Word format (1 electronic & 5 hardcopies).

2. The EPA QA Representative will provide written & oral comments to the EPA WAM and other EPA technical representative's contractor within 6 weeks of the delivery of the QA/QC plan (Item 1 above).

3. The contractor shall prepare monthly reports as required by the specific needs of this study. These reports shall be provided to the EPA WAM in an MS Word format (1 electronic & 5 hardcopies).

The EPA WAM will provide written and oral comments to the contractor within 7 days of the delivery of the monthly report.

Summary of Deliverables		
Item	**Description**	**Due Date**
a	QA/QC Plan	Input required 6 weeks after delivery of draft QAPP by WACOR
b	Email Summaries	2-days after each conference call
c	Monthly Reports	10-days after end of month

8 SPECIAL TERMS AND CONDITIONS

Attachment	Contents
A	Monitoring Protocol (To be supplied by WACOR as e-version PDF)
B	Site Map
C	QA Requirements

ATTACHMENT #1 TO THE STATEMENT OF WORK (SOW) FOR MEASUREMENT PROJECTS

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function;
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan: prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf**

TO BE SUBMITTED POST-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;
(2) an organizational chart showing the position of the QA function; 07/14/08 A-2
(3) delineation of the authority and responsibilities of the QA function;
(4) the background and experience of the QA personnel who will be assigned to the project; and
(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan: prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf**

□ **Category I or II Quality Assurance Project Plan (QAPP): prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf**

X Category III or IV QAPP: prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X QAPP Requirements for Measurement Projects

□ QAPP Requirements for Secondary Data Projects

□ QAPP Requirements for Research Model Development and/or Application Projects

□ QAPP Requirements for Software Development Projects

□ QAPP Requirements for Method Development Projects

□ QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

---

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

1. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

2. PROJECT DESCRIPTION AND OBJECTIVES

2.1 Describe the process and/or environmental system to be evaluated.

2.2 State the purpose of the project and list specific project objective(s).

3. ORGANIZATION AND RESPONSIBILITIES

3.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
3.2 Include a project schedule that includes key milestones.

4. SCIENTIFIC APPROACH

4.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
4.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
4.3 Describe the general approach and the test conditions for each experimental phase.

5. SAMPLING PROCEDURES

5.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
5.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.
5.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.
5.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
5.5 Describe the method for uniquely numbering each sample.
5.6 Describe procedures for packing and shipping samples, including procedures to avoid cross- contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

6 MEASUREMENT PROCEDURES

6.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.
6.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

7. QUALITY METRICS (QA/QC CHECKS)

7.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for

performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.
7.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

8 DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

8.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.
8.2 Describe data validation procedures used to ensure the reporting of accurate project data.
8.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).
8.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.
8.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.
8.4 Describe data storage requirements for both hard copy and electronic data.

9 REPORTING

9.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.
9.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

10. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-023

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base X Option Period Number	1-023

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 1, 6

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Tiffany Yelverton	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-9456 FAX Number:
Project Officer Name Robin Baily	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Mark Cranley	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

PERFORMANCE STATEMENT OF WORK

Investigation of Emissions from Stationary Diesel Gensets with Alternative Fuels

WA #: 1-023
Contract # EP-C-15-008

WACOR: Tiffany L.B. Yelverton
Alternate WACOR: Jacky Rosati-Rowe

Period of Performance

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

I. Background

The 2011 National Emissions Standards for Hazardous Air Pollutants (NESHAP) for Reciprocating Internal Combustion Engines (RICE), written by EPA's Office of Air Quality Planning and Standards (OAQPS), regulates emissions from both diesel and spark-ignited IC engines. This RICE Rule must be revisited and updated every few years and as such, new technologies must be considered. For this reason, research with alternative fuels is necessary to attempt to meet/exceed PM (and other) pollutant emissions standards currently regulated. Further, at the time the initial ruling was proposed and finalized, it was unclear as to whether or not these diesel generators were of concern for particulate emissions, particularly black carbon (BC).

While this rule pertains to both pre- and post-combustion control of emissions, the focus of the previous portion of this study was post-combustion controls for particulate matter (PM). The current study will follow that work by looking at pre-combustion control of emissions – namely blending of alternative fuels with ultra-low sulfur diesel (ULSD). The alternative fuels being considered include, but are not limited to, natural gas, propane, and dimethyl ether (DME). While the investigation described within is a set of tests designed to determine emission factors of pollutants, it is NOT to inform OAR/OAQPS of needed emissions standards or regulations.

Specifically, this work will continue to investigate PM, BC, and gaseous emissions (CO, CO_2, O_2, etc.) from two diesel generators (5.5 and 200 kW genset), with ULSD and ULSD blended with alternative fuels at various blend ratios. Each engine and fuel combination will be run at two conditions: approximately 50% and 90% load. The exhaust from these engines will be ducted into the Highbay building (at EPA's RTP location) and into the flue gas cleaning system (FGCS or APCS). From these exhausted emissions, a slip stream will

be pulled for sampling purposes. Under certain testing conditions, dilution will be necessary in order to avoid overwhelming the measurement instrumentation.

II. Purpose

These tests will be used to further understand emissions from stationary diesel generators fueled with ULSD and alternative fuels. These tests are specifically designed to investigate particulate emissions, but will require gaseous emissions investigation as well. The ultimate goal of the investigation will be to provide emission factors for various diesel and blended fuel ratios at varying engine loads. The resulting data will be used by ORD and by OAQPS/OAR. The results of these tests will NOT be used to set emission limits or to determine NESHAP rules.

Background Information and Special Instruction

- It is expected that much of the data obtained via this work assignment may be dispensed to the general public via open presentation at technical conferences and through publication in peer-reviewed scientific journals.
- The Contractor is expected to use government furnished equipment (GFE) for this work and shall work with the WAM to accomplish these tasks.
- Facility operating manuals and standard operating procedures shall be followed when applicable and available.
- The Contractor shall participate in safety training as per EPA guidelines.
- The Contractor shall adhere to the QA requirements as delineated in Attachment #1 to the Statement of Work. Any work involving environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Stuff.

III. Statement of Work

Task 1. Develop/Review/Revise QAPP (as needed)

Prior to the start of the testing period, the Contractor shall work with the WAM to review and update the QAPP as needed in order to ensure that the description of all sampling practices/methods and the test plan are current and accurate.

Deliverables – The Contractor shall work with the WAM to review, and revise as needed, the quality assurance project plan (QAPP) to ensure its accuracy and that it is in accordance with Appendix #1 (attached) to the Performance Work Statement for each work assignment

task involving collection or generation of environmental data. The QAPP must be approved by the QAM prior to any data being acquired or used (by 05/15/2016).

Task 2: Conduct Runs According to the QAPP/Test Plan

Each test "run" shall be one 4- to 7-hour day of operation, where sampling period will depend upon fuel being tested. It is likely that two to three test runs per week shall occur. The Contractor shall be responsible for engine operation and preparation of the sampling equipment and glassware for all of the runs; however, the contractor shall not necessarily be responsible for day-to-day operation of the online black carbon (PASS3, SP2, AE22) instrumentation. The Contractor shall, in coordination with the WAM, conduct experimental runs according to the schedule and conditions described in the QAPP which includes, but is not limited to, the testing of two different generators with multiple ULSD and alternative fuel blend ratios (as described in the below table).

Projected Conditions for Each Test

Engine	Fuel	Engine Load	Number of Test Days
5.5 kW Yanmar	ULSD	~50% and ~90%	1-2
	ULSD + DME (10%)	~50% and ~90%	1-2
	ULSD + DME (20%)	~50% and ~90%	1-2
	ULSD + DME (30%)	~50% and ~90%	1-2
200 kW Kohler	ULSD	~50% and ~90%	1-2
	ULSD + Natural Gas (10%)	~50% and ~90%	1-2
	ULSD + Natural Gas (20%)	~50% and ~90%	1-2
	ULSD + Natural Gas (30%)	~50% and ~90%	1-2
	ULSD + DME (10%)	~50% and ~90%	1-2
	ULSD + DME (20%)	~50% and ~90%	1-2
	ULSD + DME (30%)	~50% and ~90%	1-2
	Total Test Days		**11-22**

Deliverables – The Contractor shall provide the WAM with an engine operator, needed test equipment, and support for sample collection for all scheduled test days.

Task 3: Coordinate Analysis of Experimental Samples

The Contractor shall, when needed, coordinate the transport and analysis of experimental samples using appropriate off-site analytical laboratories. The specific analytical requirements will be described in the QAPP. While the exact number of samples to be analyzed off-site is unknown at this time, fuel analysis as well as filters for organic and elemental carbon concentrations (NIOSH5040) may require off-site analysis.

Deliverables – The contractor shall provide chain of custody reports for all samples sent off-site for analysis as well as the results reported from these analyses. For on-site sample analysis, the Contractor shall provide results from these analyses. For off-site analyses, the contractor shall initiate transport and analysis of samples within two weeks of collection.

Task 4: Assemble Run Data and Analytical Results into a Usable Data Package and Provide a Written Summary

The Contractor shall assemble the run data (i.e. experimental conditions) and analytical results into formats that can be used or reported, as discussed with WAM. The Contractor shall work with the WAM to ensure that the appropriate data formats are used. The Contractor shall write up a short summary report following each run and should further assemble analytical data into table and plot formats if needed.

Deliverables – The Contractor shall provide analytical results and the data package within two weeks of receiving analytical reports from the off-site laboratory.

Task 5. Procurement of Fuel for Operation of the Stationary Diesel Generators

The Contractor shall procure any needed ultra-low sulphur (ULSD), non-highway diesel fuel, or chemical/gas cylinders for testing or instrumentation (e.g. DME, calibration gases, etc.). The Contractor shall work with a local company to purchase needed fuel and have it delivered to EPA's RTP campus for the purposes of this investigation. The diesel fuel shall be delivered and stored on-site in an approved storage facility. The Contractor shall be responsible for ensuring that the fuel storage facility is prepared properly, with assistance from the WAM, for the delivery of the fuel.

Deliverables – The Contractor shall provide the needed fuels for testing. The fuel shall be procured and delivered no later than two weeks after the WAM makes a request.

IV. Other Deliverables

The Contractor shall provide the WAM with a records Package at the completion of the tasks of this work assignment (03/31/2017). This electronic records package shall contain copies of laboratory data sheets, experimental observations (in a lab notebook), minutes of meetings, etc. The records package shall contain enough information such that the work could be independently repeated if desired.

The Contractor's monthly report to EPA shall summarize work activities (accomplished and planned) for each task in this work assignment, including (but not limited to) the status of applicable tests, QA, and safety plans. The monthly report shall also detail labor costs and ODC charges.

All safety and quality assurance requirements for APPCD projects are documented in protocols prepared prior to initiating a project, as required in the Contractor's contract. As part of the EPA-RTP's normal operational requirements, a detailed facility health and safety plan shall be prepared by the Contractor for each of the experimental systems that will be used for this proposed research. Health and safety protocols for each task shall be updated or prepared as required by the EPA-RTP Campus Safety personnel. These protocols shall be approved by the WAM and safety personnel prior to conducting any tests.

Appendix #1 TO THE STATEMENT OF WORK (SOW)

FOR MEASUREMENT PROJECTS

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD (mark all that apply):

□ NRMRL's Quality System Specifications:

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ Quality Management Plan: prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,

http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

□ NRMRL's Quality System Specifications:

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function; 07/14/08 A-2

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ Quality Management Plan: prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,

http://www.epa.gov/quality/qs-docs/r2-final.pdf

□ Category I or II Quality Assurance Project Plan (QAPP): prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001
http://www.epa.gov/quality/qs-docs/r5-final.pdf

X Category III or IV QAPP: prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X QAPP Requirements for Measurement Projects

□ QAPP Requirements for Secondary Data Projects

□ QAPP Requirements for Research Model Development and/or Application Projects

□ QAPP Requirements for Software Development Projects

□ QAPP Requirements for Method Development Projects

□ QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/

EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

---

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

1. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

2. PROJECT DESCRIPTION AND OBJECTIVES

2.1 Describe the process and/or environmental system to be evaluated.

2.2 State the purpose of the project and list specific project objective(s).

3. ORGANIZATION AND RESPONSIBILITIES

3.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.

3.2 Include a project schedule that includes key milestones.

4. SCIENTIFIC APPROACH

4.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.

4.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.

4.3 Describe the general approach and the test conditions for each experimental phase.

5. SAMPLING PROCEDURES

5.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.

5.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.

5.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.

5.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.

5.5 Describe the method for uniquely numbering each sample.

5.6 Describe procedures for packing and shipping samples, including procedures to avoid cross- contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

6 MEASUREMENT PROCEDURES

6.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.

6.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

7. QUALITY METRICS (QA/QC CHECKS)

7.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

7.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

8 DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

8.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

8.2 Describe data validation procedures used to ensure the reporting of accurate project data.

8.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).

8.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

8.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

8.4 Describe data storage requirements for both hard copy and electronic data.

9 REPORTING

9.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

9.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

10. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-024

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base X Option Period Number	

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Tiffany Yelverton (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-9456 FAX Number:	
Project Officer Name Robin Baily (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:	
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:	
Contracting Official Name Mark Cranley (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109	

STATEMENT OF WORK

Emissions Investigation on a Pilot-Scale Coal-Fired Combustion Facility

I. Background

This work assignment describes follow-on work to characterize emissions from the combustion of coal and/or biomass, as well as investigate various control technologies for PM and gaseous emissions. This study will focus on not only coal, but also several biomass products blended at various ratios with coal up to 80% by mass. As with previous studies, this will utilize ORD's Multipollutant Control Research Facility (MPCRF) to test a range of coal types, biomass blends, and process configurations.

The MPCRF is located in the High Bay Building (HBB) on EPA's Research Triangle Park campus. It is a pilot-scale combustion research facility rated at 4MMBtu/hr (roughly 1.2 MWt). It is capable of firing pulverized coals (and/or biomass blended with coal), natural gas, and Number 2 fuel oil. This combustor is also equipped with several control technologies: (i) low NOx burners, (ii) a selective catalytic reduction (SCR) unit (with Cormetech catalyst), (iii) an electrostatic precipitator (ESP), (iv) fabric filters (positioned in parallel), and (v) a wet lime-based flue gas desulfurization (FGD) scrubber. The facility has the capability to use many of these control technologies simultaneously or can bypass a given control for individual investigation. Furthermore, the MPCRF is equipped with continuous emissions monitors (CEMs) for on-line measurement of O_2, CO_2, NO, NO_2, SO_2, CO, and Hg. There are multiple sampling ports throughout the gas flow path. The facility has several heat exchangers in series in order to remove heat such that the flow path of the flue gas has a similar temperature profile to that seen in a full-scale power plant.

II. Purpose

These tests will be used to further examine PM and gaseous emission characterizations in order to inform OAQPS on the viability of the surrogacy approach, and the relevancy of using biomas products as "drop-in" replacements for coal, while combusting coal and coal blended with varying levels of biomass. These tests will build upon similar testing from 2012 through 2016 and will incorporate online (real-time) measurement techniques to avoid time-integrated filter samples (FTIR, aethalometer, etc.). Furthermore, the tests will also investigate the emissions from blending biomass with coal under normal operating conditions of the MPCRF. The resulting data will be used by ORD and by OAQPS/OAR.

The results of these tests will NOT be used to set emission limits or to determine the maximum achievable control technology.

Background Information and Special Instruction

- It is expected that much of the data obtained via this work assignment may be dispensed to the general public via open presentation at technical conferences and through publication in peer-reviewed scientific journals.
- The Contractor is expected to use government furnished equipment (GFE) for this work and shall work with the WAM to accomplish these tasks.
- Facility operating manuals and standard operating procedures shall be followed when applicable and available.
- The Contractor shall participate in safety training as per EPA guidelines.
- The Contractor shall adhere to the QA requirements as delineated in Attachment #1 to the Statement of Work. Any work involving environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Stuff.

III. Statement of Work

Task 1. Revise/Combine the Existing QAPP

Prior to the start of the testing period, the Contractor shall work with the WAM to determine if any updates are needed for the existing quality assurance project plan (QAPP) to ensure the description of all sampling practices/methods and the test plan are current and accurate.

Deliverables – The Contractor shall work with the WAM to review, and revise as needed, the QAPP to ensure that it is in accordance with Appendix #1 to the Performance Work Statement for each work assignment task involving collection or generation of environmental data. If updates are necessary, the revised QAPP must be approved by the QAM prior to any data acquisition or analysis (by 05/15/2016).

Task 2. Conduct Runs According to the QAPP/Test Plan

Each test "run" shall be one 8-hour day of operation, where roughly 4-hours will be a sampling period. It is likely that two to three test runs per week will occur, but typical operations will occur every other week rather than consecutive test weeks – allowing for necessary facility cleaning between tests. The Contractor shall be responsible for coal and biomass preparation (pulverizing/shredding, storage, etc.), organization and storage as well as preparation of the sampling equipment and glassware for all of the runs; however, the contractor is not necessarily responsible for day-to-day operation of the MPCRF. The Contractor shall, in coordination with the WAM, conduct experimental runs according to the

schedule and conditions described in the existing/revised QAPP which includes testing up to four different types of coal, coal blended with multiple biomass products individually, and at varying ratios of biomass with multiple configurations of the available PM, NO_x, and SO_2 control technology equipment on the MPCRF.

The Contractor shall also support similar organic species testing conducted under a separate work assignment. This support will likely include organic HAPs (e.g, aromatic VOCs and carbonyls) sampling and analysis. As this support is dependent on the collaborating work assignment, the actual support required and schedule will be provided in writing by the WAM at a later date. Therefore, while conducting these tests, the Contractor shall also be responsible for support of other experimental sampling as described under a second work assignment (WA 1-002) as determined and submitted at a later date.

Deliverables – The Contractor shall provide the WAM with pulverized (and processed) coal and biomass, clean/ready to use test equipment/sample trains, support for preparing and operating the facility, and support for sample collection for all scheduled test days.

Task 3: Design, Installation, Maintenance, and Repair of Coal/Biomass Preparation Equipment

The Contractor shall use the procured parts and equipment to continue (as needed) design, installation, maintenance, and repair of the new coal and biomass preparation and storage facility with input from the WAM. The contractor shall also be responsible for the procurement of smaller pieces of parts and equipment to complete set up and maintain the coal and biomass preparation and storage facility. Some of the physical design, construction, and repair of the coal and biomass preparation and storage facility shall be accomplished by the contractor, but under Work Assignment 1-001.

When necessary, the Contractor shall purchase coal and biomass and out-source or sub-contract coal and/or biomass processing in order to provide needed material for testing.

Deliverables – The Contractor shall aid in design (as needed), installation, maintenance, and repair of the coal and biomass preparation and storage facility such that it is useable for testing. Further, the contractor shall notify the WAM of other needed parts prior to purchase and give at least bi-weekly verbal updates on needed updates and repairs.

Task 4: Coordinate Analysis of Experimental Samples

The Contractor shall, when needed, coordinate the transport and analysis of experimental samples using appropriate off-site analytical laboratories. The specific analytical requirements will be described in the QAPP. While the exact number of samples to be analyzed off-site is unknown at this time, filters will likely need to be analyzed off-site for organic and elemental carbon concentrations (NIOSH5040), proximate/ultimate analyses of

coals and biomass products, as well as potentially arranging wet-chemistry sample train analysis.

Deliverables – The Contractor shall provide chain of custody reports for all samples sent off-site for analysis as well as the results reported from these analyses. For on-site sample analysis, the Contractor shall provide results from analyses.

Task 5: Assemble Run Data and Analytical Results into a Usable Data Package and Provide a Written Summary

The Contractor shall assemble the run data (experimental conditions, flue gas components, etc.) and analytical results into formats that can be used or reported. The Contractor shall work with the WAM to ensure that the appropriate data formats are used. The Contractor shall write up a short summary report following each run and should further assemble analytical data into table and plot formats.

Deliverables – The Contractor shall provide analytical results and the data package within two weeks of receiving analytical reports from the off-site laboratory.

Task 6: Purchase Needed Analytical Equipment

The Contractor shall purchase any needed equipment to analyze the flue gas generated from the combustion of coal blended with biomass. The equipment could include, but is not limited to: a portable FTIR or a single wavelength photoacoustic soot spectrometer. Further information regarding specific characteristics and parameters of the needed pieces of equipment will be provided by the WAM as needed.

Deliverables – The Contractor shall provide the needed equipment to be able to analytically characterize the PM and gaseous emissions from the combustion of the blended coal and biomass product(s). Further, the Contractor shall notify the WAM of arrival of all pieces of equipment such that the WAM can make arrangements for implementation and use of the instruments on the current testing.

IV. Other Deliverables

The Contractor shall provide the WAM with a records Package at the completion of the tasks of this work assignment. This records package shall contain copies of laboratory data sheets, experimental observations (in a lab notebook), minutes of meetings, etc. The records package shall contain enough information such that the work could be independently repeated if desired.

The Contractor's monthly report to EPA shall summarize work activities (accomplished and planned) for each task in this work assignment, including (but not limited to) the status of

applicable tests, QA, and safety plans. The monthly report shall also detail labor costs and ODC charges.

All safety and quality assurance requirements for APPCD projects are documented in protocols prepared prior to initiating a project, as required in the Contractor's contract. As part of the EPA-RTP's normal operational requirements, a detailed facility health and safety plan shall be prepared by the Contractor for each of the experimental systems that will be used for this proposed research. Health and safety protocols for each task shall be updated or prepared as required by the EPA-RTP Campus Safety personnel. These protocols shall be approved by the WAM and safety personnel prior to conducting any tests.

Appendix #1 TO THE STATEMENT OF WORK (SOW)

FOR MEASUREMENT PROJECTS

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD (mark all that apply):

□ NRMRL's Quality System Specifications:

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ Quality Management Plan: prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,

http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

□ NRMRL's Quality System Specifications:

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function; 07/14/08 A-2

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ Quality Management Plan: prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,

http://www.epa.gov/quality/qs-docs/r2-final.pdf

□ Category I or II Quality Assurance Project Plan (QAPP): prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001
http://www.epa.gov/quality/qs-docs/r5-final.pdf

X Category III or IV QAPP: prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X QAPP Requirements for Measurement Projects

- ☐ QAPP Requirements for Secondary Data Projects

- ☐ QAPP Requirements for Research Model Development and/or Application Projects

- ☐ QAPP Requirements for Software Development Projects

- ☐ QAPP Requirements for Method Development Projects

- ☐ QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/

EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

---

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

1. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

2. PROJECT DESCRIPTION AND OBJECTIVES

2.1 Describe the process and/or environmental system to be evaluated.

2.2 State the purpose of the project and list specific project objective(s).

3. ORGANIZATION AND RESPONSIBILITIES

3.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.

3.2 Include a project schedule that includes key milestones.

4. SCIENTIFIC APPROACH

4.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the

types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.

4.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.

4.3 Describe the general approach and the test conditions for each experimental phase.

5. SAMPLING PROCEDURES

5.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.

5.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.

5.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.

5.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.

5.5 Describe the method for uniquely numbering each sample.

5.6 Describe procedures for packing and shipping samples, including procedures to avoid cross- contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

6 MEASUREMENT PROCEDURES

6.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.

6.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

7. QUALITY METRICS (QA/QC CHECKS)

7.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

7.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

8 DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

8.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

8.2 Describe data validation procedures used to ensure the reporting of accurate project data.

8.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).

8.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

8.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

8.4 Describe data storage requirements for both hard copy and electronic data.

9 REPORTING

9.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

9.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

10. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-026

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base X Option Period Number	1-026 Mobil Monitoring

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 4, 6

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Richard Baldauf	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-4386 FAX Number:
Project Officer Name Robin Baily	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Mark Cranley	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Mobile monitoring air pollution characterization

WA Title Descriptor: Mobile monitoring to quantify motor vehicle emissions, near source, and roadside vegetation effects on near-road air quality

WA #: 1-026 WACOR: Rich Baldauf

Contract #: EP-C-15-008 Alternate WACOR: Tom Long

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

This work assignment will focus on two primary objectives:

1. Development of methods to use mobile monitoring as a chase vehicle to determine motor vehicle emission rates; conduct pilot studies in US and China
2. Use mobile and portable monitoring techniques to quantify how roadside vegetation can mitigate near-road air quality, including development of dispersion model algorithms

BACKGROUND

Recent research by the EPA shows how mobile monitoring can be used to assess motor vehicle emissions and impacts on near-road and near-source air quality. The use of mobile monitoring for vehicle emissions studies can provide a method to obtain large-scale emissions factors under real-world driving conditions. This type of technique can be especially important to obtaining emission factors in areas with little data for local emission inventories. This technique has applications for US cities as well as developing countries.

To mitigate the growing public health concerns on near-road exposures to traffic emissions, roadway design, including the presence of vegetation, has been shown to alter concentrations of traffic-generated pollutants away from the road. Field study measurements have been collected under previous studies to determine associations among vegetation and near-road air quality. In addition, studies have been conducted quantifying how solid barriers affect near-road pollutant transport and dispersion. From these studies, model algorithms have been developed. In addition, these model algorithms have also been evaluated for potential use in

describing near-road pollutant transport in the presence of vegetation barriers. The goal of this project is to evaluate and refine the vegetation model algorithm through collection of independent field data and comparing the RLINE model algorithm. Mobile monitoring will also be used to understand the impacts of different sources on local and regional air quality, including transportation-related sources like river ports, airports, and highways.

SCOPE

The contractor shall help develop methods of using an electric mobile monitoring vehicle as a chase platform to obtain motor vehicle emissions factors. This will include the supervision and training of Chinese researchers (collaborators under the EPA ORD/China Ministry of Science & Technology MOU) on the inclusion and alignment of analyzers and sampling ports on an electric vehicle, as well as supervise the development of analytical and testing strategies to optimize measurement procedures. The contractor shall supervise the Chinese researchers in conducting a field study lasting six (6) weeks in Beijing and Nanjing, China to measure particulate matter (PM), nitrogen dioxide (NO_2), and carbon dioxide (CO2) to obtain motor vehicle emission rates. The contractor will not operate the vehicle in China, but will supervise and assist in the shipping of equipment, vehicle preparation, equipment operation, and data analysis.

The contractor shall also use the electric vehicle monitoring platform and portable air quality sensors to investigate the impact of roadside vegetation on nearby air quality. This project will consist of participating in planning meetings, site location identification, assisting EPA staff in the design of roadside vegetation barriers, sampling air quality before and after the construction of a roadside vegetation barrier in Oakland, CA and Detroit, MI, and training state and local personnel on the operation of the portable sensors. Two field studies lasting for two (2) weeks each will be conducted before and after construction of the vegetative barrier in each city (total of four (4) field studies). Measurements will include particulate matter (PM), nitrogen dioxide (NO_2), and carbon monoxide (CO) near a large highway with and without roadside vegetation. These studies will include the deployment of air quality sensors, as well as mobile monitoring vehicles equipped with air monitoring and meteorology equipment. The all-electric vehicle shall be deployed to conduct real-time measurements of PM, NO_2, and CO. An SUV equipped with similar PM, NO_2, and CO instruments may also be parked and sample at a fixed location using an on-board battery pack system. The SUV sampling location will also include meteorological measurements, and may be moved during the study. The SUV may also be equipped with a mast to allow pollutant and meteorological measurements at differing heights above ground. Four (4) or more portable air quality sensor packages for PM and NO_2 will also be developed and installed at fixed locations along the vegetation barrier and clearing areas.

The roadside vegetation monitoring data will be compared to modeling results using algorithms and techniques developed to assess air pollutant transport and dispersion in the presence of solid and vegetative roadside barriers under previous WAs. The vegetative barrier algorithm will be modified as needed based on the results of the field study and consultation with the EPA WA COR. In addition to the use of the field study data, the algorithm evaluation may also require the evaluation of other data from CFD modeling and wind tunnel studies done under separate WAs and projects.

The contractor will also use mobile monitoring to assess the impacts of various source types on local and regional air quality. The contractor will collect air quality samples over multiple monitoring routes that are impacted by different sources including river port activities, airport activities, highways and industrial facilities.

TECHNICAL APROACH/OBJECTIVES

Task 1. Site Selection and Preparation: Chase and Vegetative Barrier Studies

The contractor shall recommend driving routes in the Beijing and Nanjing areas for conducting the chase study. The contractor shall visit the selected monitoring sites in coordination with EPA and Chinese personnel as required for the purpose of evaluating field sampling deployments and provide recommendations on final route selection. Final site selection will be determined by the EPA WA COR in consultation with the Chinese researchers. For the chase study in China, EPA and contractor personnel will advise Chinese collaborators in determining an initial appropriate site location, which will be done remotely and not require a separate trip to China for this purpose.

The contractor shall also provide recommendations and support in the selection of mobile and fixed site locations for conducting the vegetation barrier studies in Oakland and Detroit. This support may include identifying potential sites using on-line mapping and photography programs and reviewing recommendations by the EPA WA COR and EPA Region 9 staff. The final site selection will be provided by the EPA WA COR. While the project is leveraging tree planting from other organization's grants, the contractor will need to purchase and plant some vegetation in order to develop a barrier suitable for air quality benefits.

Task 2. Technical and Safety Support for the Electric Vehicle and SUV: Chase and Vegetative Barrier Studies

The GMAP vehicle is an electric car specially customized to support onboard sampling. Given its limited driving range and specialized design, contractor support shall provide general vehicle support and vehicle transportation to field sites. The contractor shall update and implement the safety plan for field deployment activities involving the GMAP vehicle as well as the SUV used for both GMAP

transport and field sampling. The safety plan was developed for previous studies, and includes emergency response protocols in the event that the GMAP vehicle loses power while driving on a highway or arterial road. In addition, a multi-year technical support agreement is in place to ensure that the vehicle manufacturer will provide on-site troubleshooting in the event of significant vehicle performance issues during a field campaign. Due to the age of the existing GMAP vehicle, the contractor may also need to install and equip the measurement instruments in a new electric vehicle platform. This will include equipment installation, power hookups, and safety measures. Prior to the start of field study preparation, the WACOR will inform the contractor which platform will be used. The level of effort is anticipated to be the same regardless of whether the existing GMAP or a new vehicle is used for the mobile monitoring studies.

Deliverable 2.1: Contractor shall submit an updated GMAP vehicle safety plan for the field study to the EPA WA COR prior to initiating field measurements and provide general vehicle support. If applicable, the plan developed for this option period can be used for this field study.

Deliverable 2.2: Contractor shall provide a signed agreement for technical support from the GMAP vehicle manufacturer through at least three months after the proposed completion date for this project in the contractor's project workplan, to be completed prior to initiating field measurements. This agreement shall include in-person support during domestic deployments. If applicable, the agreement developed for this option period can be used for this field study.

Task 3. Mobile Monitoring Instrumentation Support: Chase Study

The contractor shall conduct mobile monitoring instrumentation support activities prior to deployment to the field, including measurement inter-comparison tests, instrument calibration and maintenance, and development work to improve measurement accuracy. These work activities include, but are not limited to, inter-comparison activities for a one-week period of monitoring instrumentation sampling while on-board the mobile monitoring vehicles in motion and during fixed sampling. During this activity, the contractor shall supervise the Chinese researchers in instrument operation and evaluation.

Deliverable 3.1: The contractor shall provide raw time-stamped inter-comparison data to the EPA WA COR, within one week of sampling completion.

Task 4. Field Measurements: Chase Study

The contractor shall supervise and assist a six-week field monitoring study over consecutive weeks, at locations and driving routes to be determined in the Beijing and Nanjing areas under task 1 to measure motor vehicle exhaust emission rates using an electric vehicle in a chase mode. The contractor will supervise the shipment of EPA equipment to Tsinghua University in Beijing, China. The contractor will supervise the installation, calibration, operation, and maintenance of EPA instruments in the Chinese electric vehicle used for sampling. The contractor will

also assist in data collection and analysis from the instruments. All on-road operations of the electric vehicle will be conducted by the Chinese researchers. An approved Category III QAPP has been completed for this study. In the event that inclement weather or other unavoidable circumstances prevent field sampling, a sampling day may be cancelled and rescheduled to meet the target of 30 sampling days for the studies.

Task 5. Technical Support for the Portable Sensors: Vegetative Barrier Study

The contractor shall recommend, purchase (as Contractor Acquired Equipment), and operate portable air quality sensors to measure the impacts of roadside vegetation barriers on downwind air quality. The contractor shall consult EPA experts on air quality sensors to recommend samplers for PM, BC and NO2 capable of providing measurements at ambient air concentrations to be expected near large roadways. Up to five (5) sampling packs will be needed for this study. In addition, environmental monitoring shelters with power (battery and/or solar) will need to be established for this project if not already provided by the manufacturer(s). These systems will utilize hand-held monitoring equipment and GPS capabilities into an integrated system capable of mapping spatial distributions of pollutant concentrations. Contractor support shall include general equipment support and transportation/shipment to the field sites. The contractor shall update and implement the standard operating procedures (SOP) for field deployment involving these systems. The SOPs include equipment descriptions and operations, instrument setup and maintenance, instrument calibration and maintenance, data storage, and data retrieval. The contractor shall also conduct a one-week, inter-comparison study of the samplers to determine the accuracy and precision of the samplers. Accuracy and precision will be assessed by collocation of all sensors at the Raleigh Near-Road Monitoring Station. As part of this study, the contractor shall provide support in converting raw data files from the sampling instruments into Excel spreadsheets. Contractor support shall also adhere to applicable Quality Assurance Project Plans (QAPPs).

Deliverable 5.1: Contractor shall submit an updated SOP for the use of the portable air quality sensors sampling systems for use in Oakland and Detroit to the EPA WA COR prior to initiating field measurements. If applicable, the SOP developed for this option period can be used for this field study.

Deliverable 5.2: The contractor shall provide raw time-stamped and statistically analyzed (scatterplots, correlation coefficients) inter-comparison data to the EPA WA COR, within two weeks of sampling completion.

Task 6. Mobile Monitoring Field Measurements: Vegetative Barrier Study

The contractor shall conduct mobile monitoring instrumentation support activities prior to deployment to the field, including measurement inter-comparison tests, instrument calibration and maintenance, and development work to improve

measurement accuracy. These work activities include, but are not limited to, inter-comparison activities for a one-week period of monitoring instrumentation sampling while on-board the mobile monitoring vehicles in motion and during fixed sampling.

The contractor shall conduct two mobile monitoring field studies for a two-week period in both Oakland, California and Detroit, Michigan. The field study will collect mobile monitoring data for CO, NO2, and PM in the vicinity of the vegetative barrier plantings in each city. The mobile route shall include behind the barrier, behind the clearing, multiple distances from the highway, and on the highway. The route will be selected as part of Task 1. This monitoring will be done in conjunction with the portable sensor monitoring described in Task 7.

As part of the mobile monitoring field studies, the vehicle will be placed parked next to a state run NAAQS monitoring site at the beginning of each week for an approximately 2-hour time period for comparison with the regulatory monitoring values. There is a state-run NAAQS monitoring station within approximately 5 km of each site. The contractor shall work with the respective state to obtain the monitoring data for the time periods of collocated measurements. In addition to the mobile monitoring vehicle, the contractor shall also place the portable sensors used in Task 7 at the NAAQS station for the same time periods in order to obtain collocated data for all measurement equipment.

Deliverable 6.1: The contractor shall provide raw time-stamped and statistically analyzed (scatterplots, correlation coefficients) inter-comparison data to the EPA WA COR, within two weeks of sampling completion.

Task 7. Portable Sensors Field Measurements: Vegetative Barrier Study

The contractor shall conduct four, 2-week field monitoring studies: two in Oakland, California and two in Detroit, Michigan prior to and after the construction of a roadside vegetation barrier at the respective monitoring site locations identified under Task 1. The study will consist of the deployment of the portable, air quality sensors and meteorological monitoring equipment at the study location. The equipment will all be operated within an approximately 500m-by-500m square area prior to and after the vegetative barrier construction. Some samplers may be required at different heights above ground, requiring a stand for sampler deployment. The contractor shall conduct pre- and post-sampling maintenance and calibration of all samplers as outlined in the SOP. The contractor shall also set-up and maintain sampler operation in the field, and store and collect all measurement data. Two sets of samplers and sonic anemometer meteorological equipment may also be located on a mast to collect data at multiple heights above ground. In addition to the collection of air monitoring data, the contractor shall also document roadway properties including terrain, nearby vegetation and other structures, and location and characteristics of the monitoring sites. The contractor shall also collect video of highway and any adjacent road activities in the vicinity of the site during data collection. The field sampling campaigns will be manned with personnel having expertise and experience on portable and mobile monitoring sampling field

applications sufficient to ensure a minimum 80% completeness Data Quality Objective, as described in the QAPP, and provide future training to state and local partners in the study. The field sampling configurations and quality assurance requirements are described in an approved Category III QAPP which will be provided by the EPA WA COR with assistance from the contractor. The QAPP shall be applicable to the studies in both Oakland and Detroit. This QAPP shall be accompanied by a signature page that is signed by the Jacobs work assignment leader and QA officer to show that they have reviewed and approved the QAPP. It is the responsibility of the Jacobs work assignment leader to document this process. Upon receipt of the signed QAPP, the EPA work assignment manager and QA manager will review and approve the QAPP and they will add their signatures to the signature page. Work involving environmental data shall not commence until the QAPP has received official approval from the EPA Quality Assurance Staff. In the event that inclement weather or other unavoidable circumstances prevent field sampling, a sampling day may be cancelled and rescheduled to meet the target of 20 sampling days for the study.

Deliverable 7.1: The contractor shall provide raw time-stamped concentration and meteorological data from the four, 2-week studies in Oakland, California and Detroit, Michigan to the EPA WA COR (e.g. upload to a shared file folder or e-mailed to the EPA WA COR) within 3 days of data collection. The data to be reported and formatting will be described in the QAPP.

Deliverable 7.2: The contractor shall provide a complete data package (DP) for the each of the four, 2-week roadside vegetation studies in Oakland, California and Detroit, Michigan within 4 weeks of field monitoring completion. The DP shall include field notes, quality-assured field data, in-field quality indicators, calibration checks (to be outlined in the QAPP), and video. No contractor-generated report will be required as a deliverable.

Task 8. Air Quality Modeling: Vegetative Barrier Study

The contractor shall use the results of previous field measurements around vegetation barriers (collected under previous WAs) to develop and evaluate a dispersion model algorithm for estimating the impacts of vegetative barriers on near roadway air pollutants. Based on results of the evaluation, the contractor shall modify model algorithms to account for the effects of vegetative barriers to assist with the design and evaluation of the constructed barriers in San Francisco and Detroit.

The contractor shall also implement the vegetation barrier algorithm into the R-LINE model, test it, make modifications as necessary, and compare model results with field study data as follows:

- Prepare model inputs (including source configurations, meteorological characterizations and model receptors) for simulating the test periods of vegetative/porous barrier field measurements, including but not limited to

the following near-roadway studies: Wind Tunnel (data will be provided by EPA), Mebane (data will be provided by EPA), Chapel Hill (data will be provided by EPA), Detroit (collected under WA2-40) and the California field study (collected under WA5-40).

- Perform model simulations using dispersion models selected for this study (e.g. R-LINE, CTAG) and the inputs for the studies identified in this task above
- Process model output files for comparison with field measurements from the studies identified in this task above
- Compare modeled and measured concentrations for the solid and vegetative/porous barrier cases
- Calculate model performance metrics such as bias, standard deviation, and geometric mean as functions of downwind distance, and meteorological parameters (stability, u-star, and wind speed)
- Perform model sensitivity to investigate the impact of gaps in vegetation barriers
- Develop parameterizations based on selected barrier parameters (e.g. geometry, porosity, vegetation type, and meteorology)
- Implement modifications to the barrier algorithm methodology into R-LINE using FORTRAN

Deliverable 8.1: The contractor shall provide a database of model inputs for the field studies to be evaluated (historical data)

Deliverable 8.2: The contractor shall provide model outputs for all model calculations

Deliverable 8.3: The contractor shall provide a description and model code for the vegetation barrier algorithm

Deliverable 8.4: The contractor shall provide a summary report of model vs. measurement results for the field studies evaluated that includes a list of field studies evaluated (including the work under this WA), model inputs used, comparison of performance metrics, and results from the sensitivity simulations.

Task 9. Mobile Monitoring Field Measurements: Near-Source Study

The contractor shall conduct a 2-week mobile monitoring study in Memphis, Tennessee, during morning commute periods. The several hour mobile monitoring sessions shall be conducted at up to three (3) locations in the Memphis area, to be determined by the WA COR. The storage and charging facility is anticipated to be made available by a local air monitoring agency partner as identified by the WA COR. The contractor shall provide trailer transportation to bring the car to and

from the Memphis area, as well as from the storage/charging facility to and from each of the three sampling locations. This study is anticipated to occur directly after the mobile monitoring field study in Detroit, Michigan, so pre-study equipment evaluations will not be required. In addition, this work will be covered in the vegetative barrier QAPP.

Deliverable 9.1: The contractor shall provide raw and quality-reviewed data to the WA COR within 60 days of sampling completion.

WA SPECIFIC EQUIPMENT

The contractor shall purchase (as Contractor Acquired Equipment) portable air quality sensors to measure the impacts of roadside vegetation barriers on downwind air quality. The contractor shall consult EPA experts on air quality sensors to recommend samplers for PM, BC and NO2 capable of providing measurements at ambient air concentrations to be expected near large roadways. Up to five (5) sampling packs will be needed for this study. In addition, environmental monitoring shelters will need to be established for this project if not already provided by the manufacturer(s). These systems will utilize hand-held monitoring equipment and GPS capabilities into an integrated system capable of mapping spatial distributions of pollutant concentrations. The contractor shall also purchase equipment needed for calibration, maintenance and operation of the equipment identified in this WA including calibration gases, fittings, tubing, etc. The contractor shall obtain and operate Government Furnished Equipment as specified in this WA including air quality analyzers, the GMAP and SUV mobile monitoring vehicles, and select portable samplers.

QUALITY ASSURANCE

A QAPP has been approved for the chase vehicle field studies. The field sampling configurations and quality assurance requirements are described in an approved Category III QAPP which will be provided by the EPA WA COR with assistance from the contractor. The QAPP shall be applicable to the studies in both Oakland and Detroit. This QAPP shall be accompanied by a signature page that is signed by the Jacobs work assignment leader and QA officer to show that they have reviewed and approved the QAPP. It is the responsibility of the Jacobs work assignment leader to document this process. Upon receipt of the signed QAPP, the EPA work assignment manager and QA manager will review and approve the QAPP and they will add their signatures to the signature page. Work involving environmental data shall not commence until the QAPP has received official approval from the EPA Quality Assurance Staff.

DELIVERABLES WITH SCHEDULE

Deliverable 2.1: Contractor shall submit an updated GMAP vehicle safety plan for the field study to the EPA WA COR prior to initiating field measurements and provide general vehicle support. If applicable, the plan developed for this option period can be used for this field study (at least 30 days prior to field study)

Deliverable 2.2: Contractor shall provide a signed agreement for technical support from the GMAP vehicle manufacturer through at least three months after the proposed completion date for this project in the contractor's project workplan, to be completed prior to initiating field measurements. This agreement shall include in-person support during domestic deployments. If applicable, the agreement developed for this option period can be used for this field study (at least 30 days prior to field study)

Deliverable 3.1: The contractor shall provide raw time-stamped inter-comparison data to the EPA WA COR, within one week of sampling completion (at least 30 days prior to field study)

Deliverable 5.1: Contractor shall submit an updated SOP for the use of the portable air quality sensors sampling systems for use in Oakland and Detroit to the EPA WA COR prior to initiating field measurements. If applicable, the SOP developed for this option period can be used for this field study (at least 15 days prior to field study)

Deliverable 5.2: The contractor shall provide raw time-stamped and statistically analyzed (scatterplots, correlation coefficients) inter-comparison data to the EPA WA COR (within two weeks of sampling completion)

Deliverable 6.1: The contractor shall provide raw time-stamped and statistically analyzed (scatterplots, correlation coefficients) inter-comparison data to the EPA WA COR (within two weeks of sampling completion)

Deliverable 7.1: The contractor shall provide raw time-stamped concentration and meteorological data from the four, 2-week studies in Oakland, California and Detroit, Michigan to the EPA WA COR (e.g. upload to a shared file folder or e-mailed to the EPA WA COR). The data to be reported and formatting will be described in the QAPP (within 3 days of data collection)

Deliverable 7.2: The contractor shall provide a complete data package (DP) for the each of the four, 2-week roadside vegetation studies in Oakland, California and Detroit, Michigan. The DP shall include field notes, quality-assured field data, in-field quality indicators, calibration checks (to be outlined in the QAPP), and video. No contractor-generated report will be required as a deliverable (within 4 weeks of field monitoring completion)

Deliverable 8.1: The contractor shall provide a database of model inputs for the field studies to be evaluated based on historical data (within 60 days of project initiation)

Deliverable 8.2: The contractor shall provide model outputs for all model calculations (within 90 days of Deliverable 8.1)

Deliverable 8.3: The contractor shall provide a description and model code for the vegetation barrier algorithm (within 300 days of Deliverable 8.1)

Deliverable 8.4: The contractor shall provide a summary report of model vs. measurement results for the field studies evaluated that includes a list of field studies evaluated (including the work under this WA), model inputs used, comparison of performance metrics, and results from the sensitivity simulations (within 300 days of Deliverable 8.1)

Deliverable 9.1: The contractor shall provide raw and quality-reviewed data to the WA COR (within 60 days of sampling completion)

ATTACHMENT #1 TO THE STATEMENT OF WORK (SOW)

FOR MEASUREMENT PROJECTS

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

□ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,

http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function; 07/14/08 A-2

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,

http://www.epa.gov/quality/qs-docs/r2-final.pdf

☐ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X **QAPP Requirements for Measurement Projects**

☐ **QAPP Requirements for Secondary Data Projects**

☐ **QAPP Requirements for Research Model Development and/or Application Projects**

☐ **QAPP Requirements for Software Development Projects**

☐ **QAPP Requirements for Method Development Projects**

☐ **QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/

EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

---

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.

1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.

2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.

3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.

3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.

4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.

4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.

4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.

4.5 Describe the method for uniquely numbering each sample.

4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5 MEASUREMENT PROCEDURES

5.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.

5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6 QUALITY METRICS (QA/QC CHECKS)

6.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

6.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7 DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

7.2 Describe data validation procedures used to ensure the reporting of accurate project data.

7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).

7.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

7.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

7.4 Describe data storage requirements for both hard copy and electronic data.

8 REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-026

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2016
Base Option Period Number 1

Title of Work Assignment/SF Site Name:

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:
The purpose of this amendment is to revise and add task to the PWS. Revised work plan and cost estimate due 9/26/16.

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2016 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee — LOE:

Cumulative Approved: — Cost/Fee — LOE:

Work Assignment Manager Name: Richard Baldauf
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-4386
FAX Number:

Project Officer Name: Robin S. Harris
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0955
FAX Number:

Other Agency Official Name:
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Mobile monitoring air pollution characterization

WA Title Descriptor: Mobile monitoring to quantify motor vehicle emissions, near source, and roadside vegetation effects on near-road air quality

WA #: 1-026, Amendment #1 WACOR: Rich Baldauf

Contract #: EP-C-15-008 Alternate WACOR: Tom Long

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

This work assignment will focus on ~~two~~ three primary objectives:

1. Development of methods to use mobile monitoring as a chase vehicle to determine motor vehicle emission rates; conduct pilot studies in US and China
2. Use mobile and portable monitoring techniques to quantify how roadside vegetation can mitigate near-road air quality, including development of dispersion model algorithms
3. ~~2.~~ Use mobile monitoring to assess impacts from motor vehicles and other sources (rail, industrial) to understand community impacts and evaluate modeling and data analysis techniques for local and national applications

BACKGROUND

Recent research by the EPA shows how mobile monitoring can be used to assess motor vehicle emissions and impacts on near-road and near-source air quality. The use of mobile monitoring for vehicle emissions studies can provide a method to obtain large-scale emissions factors under real-world driving conditions. This type of technique can be especially important to obtaining emission factors in areas with little data for local emission inventories. This technique has applications for US cities as well as developing countries.

To mitigate the growing public health concerns on near-road exposures to traffic emissions, roadway design, including the presence of vegetation, has been shown to alter concentrations of traffic-generated pollutants away from the road. Field study measurements have been collected under previous studies to determine

associations among vegetation and near-road air quality. In addition, studies have been conducted quantifying how solid barriers affect near-road pollutant transport and dispersion. From these studies, model algorithms have been developed. In addition, these model algorithms have also been evaluated for potential use in describing near-road pollutant transport in the presence of vegetation barriers. The goal of this project is to evaluate and refine the vegetation model algorithm through collection of independent field data and comparing the RLINE model algorithm. Mobile monitoring will also be used to understand the impacts of different sources on local and regional air quality, including transportation-related sources like river ports, airports, and highways.

SCOPE

The contractor shall help develop methods of using an electric mobile monitoring vehicle as a chase platform to obtain motor vehicle emissions factors. This will include the supervision and training of Chinese researchers (collaborators under the EPA ORD/China Ministry of Science & Technology MOU) on the inclusion and alignment of analyzers and sampling ports on an electric vehicle, as well as supervise the development of analytical and testing strategies to optimize measurement procedures. The contractor shall supervise the Chinese researchers in conducting a field study lasting six (6) weeks in Beijing and Zhangjiakou, China to measure particulate matter (PM), nitrogen dioxide (NO_2), and carbon dioxide (CO2) to obtain motor vehicle emission rates. The contractor will not operate the vehicle in China, but will supervise and assist in the shipping of equipment, vehicle preparation, equipment operation, and data analysis.

The contractor shall also use the electric vehicle monitoring platform and portable air quality sensors to investigate the impact of roadside vegetation on nearby air quality. This project will consist of participating in planning meetings, site location identification, assisting EPA staff in the design of roadside vegetation barriers, sampling air quality before and after the construction of a roadside vegetation barrier in Oakland, CA and Detroit, MI, and training state and local personnel on the operation of the portable sensors. Two field studies lasting for two (2) weeks each will be conducted before and after construction of the vegetative barrier in each city (total of four (4) field studies). Measurements will include particulate matter (PM), nitrogen dioxide (NO_2), and carbon monoxide (CO) near a large highway with and without roadside vegetation. These studies will include the deployment of air quality sensors, as well as mobile monitoring vehicles equipped with air monitoring and meteorology equipment. The all-electric vehicle shall be deployed to conduct real-time measurements of PM, NO_2, and CO. An SUV equipped with similar PM, NO_2, and CO instruments may also be parked and sample at a fixed location using an on-board battery pack system. The SUV sampling location will also include meteorological measurements, and may be moved during the study. The SUV may also be equipped with a mast to allow pollutant and meteorological measurements

at differing heights above ground. Four (4) or more portable air quality sensor packages for PM and NO_2 will also be developed and installed at fixed locations along the vegetation barrier and clearing areas.

The roadside vegetation monitoring data will be compared to modeling results using algorithms and techniques developed to assess air pollutant transport and dispersion in the presence of solid and vegetative roadside barriers under previous WAs. The vegetative barrier algorithm will be modified as needed based on the results of the field study and consultation with the EPA WA COR. In addition to the use of the field study data, the algorithm evaluation may also require the evaluation of other data from CFD modeling and wind tunnel studies done under separate WAs and projects.

The contractor will also use mobile monitoring to assess the impacts of various source types on local and regional air quality. The contractor will collect air quality samples over multiple monitoring routes that are impacted by different sources including railyards, river port activities, airport activities, highways and industrial facilities in complex urban areas that will also be collecting fixed-site air quality data using portable sensor networks.

The contractor will also evaluate how mobile and fixed-site monitoring can be used to assess mobile source emission inventories and models to identify and assess techniques for using these models to conduct national-scale assessments on the impacts of emission control and other pollution mitigation strategies on human health and air quality benefits.

TECHNICAL APROACH/OBJECTIVES

Task 1. Site Selection and Preparation: Chase and Vegetative Barrier Studies

The contractor shall recommend driving routes in the Beijing and Zhangjiakou areas for conducting the chase study. The contractor shall visit the selected monitoring sites in coordination with EPA and Chinese personnel as required for the purpose of evaluating field sampling deployments and provide recommendations on final route selection. Final site selection will be determined by the EPA WA COR in consultation with the Chinese researchers. For the chase study in China, EPA and contractor personnel will advise Chinese collaborators in determining an initial appropriate site location, which will be done remotely and not require a separate trip to China for this purpose.

The contractor shall also conduct field sampling the Research Triangle Park, North Carolina area using similar techniques and methods used in the China studies. The contractor shall develop and improve based on lessons learned from the China field studies to improve the chase vehicle methodology and obtain emission factor estimates from on-road US vehicles. The contractor shall also work with EPA to

conduct chase studies of vehicles equipped with PEMS units under a separate EPA work assignment.

The contractor shall also provide recommendations and support in the selection of mobile and fixed site locations for conducting the vegetation barrier studies in Oakland and Detroit. This support may include identifying potential sites using on-line mapping and photography programs and reviewing recommendations by the EPA WA COR and EPA Region 9 staff. The final site selection will be provided by the EPA WA COR. While the project is leveraging tree planting from other organization's grants, the contractor will need to purchase and plant some vegetation in order to develop a barrier suitable for air quality benefits.

Task 2. Technical and Safety Support for the Electric Vehicle and SUV: ~~Chase and Vegetative Barrier~~All Studies

The GMAP vehicle is an electric car specially customized to support onboard sampling. Given its limited driving range and specialized design, contractor support shall provide general vehicle support and vehicle transportation to field sites. The contractor shall update and implement the safety plan for field deployment activities involving the GMAP vehicle as well as the SUV used for both GMAP transport and field sampling. The safety plan was developed for previous studies, and includes emergency response protocols in the event that the GMAP vehicle loses power while driving on a highway or arterial road. In addition, a multi-year technical support agreement is in place to ensure that the vehicle manufacturer will provide on-site troubleshooting in the event of significant vehicle performance issues during a field campaign. Due to the age of the existing GMAP vehicle, the contractor may also need to install and equip the measurement instruments in a new electric vehicle platform. This will include equipment installation, power hookups, and safety measures. Prior to the start of field study preparation, the WACOR will inform the contractor which platform will be used. The level of effort is anticipated to be the same regardless of whether the existing GMAP or a new vehicle is used for the mobile monitoring studies.

Deliverable 2.1: Contractor shall submit an updated GMAP vehicle safety plan for ~~the~~ all field ~~study~~ studies to the EPA WA COR prior to initiating field measurements and provide general vehicle support. If applicable, the plan developed for this option period can be used for this field study.

Deliverable 2.2: Contractor shall provide a signed agreement for technical support from the GMAP vehicle manufacturer through at least three months after the proposed completion date for this project in the contractor's project workplan, to be completed prior to initiating field measurements. This agreement shall include in-person support during domestic deployments. If applicable, the agreement developed for this option period can be used for this field study.

Deliverable 2.3: Contractor shall provide a safe, working GMAP vehicle equipped with instruments required under this work assignment, including making any

repairs and improvements needed to the GMAP vehicle to fully implement the field studies

Task 3. Mobile Monitoring Instrumentation Support: Chase Study

The contractor shall conduct mobile monitoring instrumentation support activities prior to deployment to the field, including measurement inter-comparison tests, instrument calibration and maintenance, and development work to improve measurement accuracy. These work activities include, but are not limited to, inter-comparison activities for a one-week period of monitoring instrumentation sampling while on-board the mobile monitoring vehicles in motion and during fixed sampling. During this activity, the contractor shall supervise the Chinese researchers in instrument operation and evaluation.

Deliverable 3.1: The contractor shall provide raw time-stamped inter-comparison data to the EPA WA COR, within one week of sampling completion for the RTP study.

Task 4. Field Measurements: Chase Study

The contractor shall supervise and assist a six-week field monitoring study over consecutive weeks, at locations and driving routes to be determined in the Beijing and Nanjing areas under task 1 to measure motor vehicle exhaust emission rates using an electric vehicle in a chase mode. The contractor will supervise the shipment of EPA equipment to Tsinghua University in Beijing, China. The contractor will supervise the installation, calibration, operation, and maintenance of EPA instruments in the Chinese electric vehicle used for sampling. The contractor will also assist in data collection and analysis from the instruments. All on-road operations of the electric vehicle will be conducted by the Chinese researchers. An approved Category III QAPP has been completed for this study. In the event that inclement weather or other unavoidable circumstances prevent field sampling, a sampling day may be cancelled and rescheduled to meet the target of 30 sampling days for the studies.

The contractor shall lead a two-week study in the Research Triangle Park, North Carolina area to measure NO2, CO2, BC and UFP emissions using the methods developed during the China study. The contractor shall implement the China study protocol and make recommendations for improvements in the methodology based on lessons learned in China. For a portion of the time, the electric vehicle will follow a vehicle equipped with a PEMS unit as part of a separate EPA work assignment

Deliverable 4.1: The contractor shall provide raw time-stamped chase study data to the EPA WA COR, within one week of sampling completion for the RTP study.

Deliverable 4.2: The contractor shall provide a report summarizing the results of the measurements in the RTP study including sampler QA, estimated motor vehicle

emission factors and assessment of the chase method within 8 weeks of study completion

Task 5. Technical Support for the Portable Sensors: Vegetative Barrier Study

The contractor shall recommend, purchase (as Contractor Acquired Equipment), and operate portable air quality sensors to measure the impacts of roadside vegetation barriers on downwind air quality. The contractor shall consult EPA experts on air quality sensors to recommend samplers for PM, BC and NO2 capable of providing measurements at ambient air concentrations to be expected near large roadways. Up to ~~five~~ eight (~~8~~5) sampling packs will be needed for this study. In addition, environmental monitoring shelters with power (battery and/or solar) will need to be established for this project if not already provided by the manufacturer(s). These systems will utilize hand-held monitoring equipment and GPS capabilities into an integrated system capable of mapping spatial distributions of pollutant concentrations. Contractor support shall include general equipment support and transportation/shipment to the field sites. The contractor shall update and implement the standard operating procedures (SOP) for field deployment involving these systems. The SOPs include equipment descriptions and operations, instrument setup and maintenance, instrument calibration and maintenance, data storage, and data retrieval. The contractor shall also conduct a one-week, inter-comparison study of the samplers to determine the accuracy and precision of the samplers. Accuracy and precision will be assessed by collocation of all sensors at the Raleigh Near-Road Monitoring Station for a two-week period. As part of this study, the contractor shall provide support in converting raw data files from the sampling instruments into Excel spreadsheets. Contractor support shall also adhere to applicable Quality Assurance Project Plans (QAPPs).

Deliverable 5.1: Contractor shall submit an updated SOP for the use of the portable air quality sensors sampling systems for use in Oakland and Detroit to the EPA WA COR prior to initiating field measurements. If applicable, the SOP developed for this option period can be used for this field study.

Deliverable 5.2: The contractor shall provide raw time-stamped and statistically analyzed (scatterplots, correlation coefficients) inter-comparison data to the EPA WA COR, within ~~two~~ four weeks of sampling completion.

Task 6. Mobile Monitoring Field Measurements: Vegetative Barrier Study

The contractor shall conduct mobile monitoring instrumentation support activities prior to deployment to the field, including measurement inter-comparison tests, instrument calibration and maintenance, and development work to improve measurement accuracy. These work activities include, but are not limited to, inter-comparison activities for a one-week period of monitoring instrumentation sampling while on-board the mobile monitoring vehicles in motion and during fixed sampling.

The contractor shall conduct two mobile monitoring field studies for a ~~two~~four-week period in both Oakland, California and Detroit, Michigan. After the planting has been completed, a measurement campaign will be conducted for a four-week period at each city. The vegetation planting will be conducted by external partners in each city, so the start dates of the field studies will be contingent on the completion of the vegetation barrier planting. The EPA will provide the contractor with a notice of at least 1 month so there is sufficient time to prepare for the study once the planting has occurred. The field study will collect mobile monitoring data for CO2, NO2, and PM in the vicinity of the vegetative barrier plantings in each city. The mobile route shall include behind the barrier, behind the clearing, multiple distances from the highway, and on the highway. The route will be selected as part of Task 1. This monitoring will be done in conjunction with the portable sensor monitoring described in Task 7. For the study measurements in Detroit, the contractor shall include a vehicle following the GMAP to insure safety of the driver and equipment.

As part of the post-planting mobile monitoring field studies, the vehicle will be placed parked next to a state run NAAQS monitoring site at the beginning of each week for an approximately 2-hour time period for comparison with the regulatory monitoring values. There is a state-run NAAQS monitoring station within approximately 5 km of each site. The contractor shall work with the respective state to obtain the monitoring data for the time periods of collocated measurements. In addition to the mobile monitoring vehicle, the contractor shall also place the portable sensors used in Task 7 at the NAAQS station for the same time periods in order to obtain collocated data for all measurement equipment.

In Oakland, the EPA anticipates that other mobile monitoring vehicles will be operating at the site by Google and the California Air Resources Board. The contractor shall collocate the GMAP vehicle with these other mobile monitoring vehicles for a minimum of 30-minutes each sampling day. The contractor shall also coordinate driving routes and sampling times as needed with these project partners.

Deliverable 6.1: The contractor shall provide raw time-stamped and statistically analyzed (scatterplots, correlation coefficients) inter-comparison data to the EPA WA COR, within two weeks of sampling completion.

Deliverable 6.2: The contractor shall provide a report for the Oakland, California measurement campaigns comparing the mobile monitoring measurements with the GMAP, Google and California ARB mobile monitoring vehicles include the methods used in the study, data analysis of the measurements collected, and trends from the analysis for data collected. This could be a separate report or combined with the report for Deliverable 7.3 under Task 7

Task 7. Portable Sensors Field Measurements: Vegetative Barrier Study

The contractor shall conduct four ~~, 2-week~~ field monitoring studies as described in Task 6: two in Oakland, California and two in Detroit, Michigan prior to and after

the construction of a roadside vegetation barrier by external partners at the respective monitoring site locations identified under Task 1. The study will consist of the deployment of the portable, air quality sensors and meteorological monitoring equipment at the study location. The equipment will all be operated within an approximately 500m-by-500m square area prior to and after the vegetative barrier construction. Some samplers may be required at different heights above ground, requiring a stand for sampler deployment. The contractor shall conduct pre- and post-sampling maintenance and calibration of all samplers as outlined in the SOP. The contractor shall also set-up and maintain sampler operation in the field, and store and collect all measurement data. Two sets of samplers and sonic anemometer meteorological equipment may also be located on a mast to collect data at multiple heights above ground. In addition to the collection of air monitoring data, the contractor shall also document roadway properties including terrain, nearby vegetation and other structures, and location and characteristics of the monitoring sites. The contractor shall also collect video of highway and any adjacent road activities in the vicinity of the site during data collection. The field sampling campaigns will be manned with personnel having expertise and experience on portable and mobile monitoring sampling field applications sufficient to ensure a minimum 80% completeness Data Quality Objective, as described in the QAPP, and provide future training to state and local partners in the study. The field sampling configurations and quality assurance requirements are described in an approved Category III QAPP which will be provided by the EPA WA COR with assistance from the contractor. The QAPP shall be applicable to the studies in both Oakland and Detroit. This QAPP shall be accompanied by a signature page that is signed by the Jacobs work assignment leader and QA officer to show that they have reviewed and approved the QAPP. It is the responsibility of the Jacobs work assignment leader to document this process. Upon receipt of the signed QAPP, the EPA work assignment manager and QA manager will review and approve the QAPP and they will add their signatures to the signature page. Work involving environmental data shall not commence until the QAPP has received official approval from the EPA Quality Assurance Staff. In the event that inclement weather or other unavoidable circumstances prevent field sampling, a sampling day may be cancelled and rescheduled to meet the target of 20 sampling days for the study.

Deliverable 7.1: The contractor shall provide raw time-stamped concentration and meteorological data from the four ~~, 2-week~~ studies, two in Oakland, California and two in Detroit, Michigan, to the EPA WA COR (e.g. upload to a shared file folder or e-mailed to the EPA WA COR) within 3 days of data collection. The data to be reported and formatting will be described in the QAPP.

Deliverable 7.2: The contractor shall provide a complete data package (DP) for the each of the four ~~, 2-week~~ roadside vegetation studies, two in Oakland, California and two in Detroit, Michigan within 4 weeks of field monitoring completion. The DP shall include field notes, quality-assured field data, in-field quality indicators,

calibration checks (to be outlined in the QAPP), and video. No contractor-generated report will be required as a deliverable. This DP will include data collected in Tasks 6 and 7

Deliverable 7.3: The contractor shall provide a report for the two Oakland, California measurement campaigns detailing the methods used in the study, data analysis of the measurements collected, and trends from the analysis for data collected under Tasks 6 and 7 within 10 weeks of field monitoring completion for the second, post-planting field study

Deliverable 7.4: The contractor shall provide a report for the two Detroit, Michigan measurement campaigns detailing the methods used in the study, data analysis of the measurements collected, and trends from the analysis for data collected under Tasks 6 and 7 within 10 weeks of field monitoring completion for the second, post-planting field study

Deliverable 7.5: The contractor shall submit a summary of how the results from the Oakland and Detroit field studies could be used to design and assess the benefits of using roadside vegetation for walking and biking paths along busy roads, including a comparison with a case study

Task 8. Air Quality Modeling: Vegetative Barrier Study

The contractor shall use the results of previous field measurements around vegetation barriers (collected under previous WAs) to develop and evaluate a dispersion model algorithm for estimating the impacts of vegetative barriers on near roadway air pollutants. Based on results of the evaluation, the contractor shall modify model algorithms to account for the effects of vegetative barriers to assist with the design and evaluation of the constructed barriers in Oakland and Detroit.

The contractor shall also implement the vegetation barrier algorithm into the R-LINE model, test it, make modifications as necessary, and compare model results with field study data as follows:

- Prepare model inputs (including source configurations, meteorological characterizations and model receptors) for simulating the test periods of vegetative/porous barrier field measurements, including but not limited to the following near-roadway studies: Wind Tunnel (data will be provided by EPA), Mebane (data will be provided by EPA), Chapel Hill (data will be provided by EPA), Detroit (collected under WA2-40) and the California field study (collected under WA5-40).
- Perform model simulations using dispersion models selected for this study (e.g. R-LINE, CTAG) and the inputs for the studies identified in this task above

- Process model output files for comparison with field measurements from the studies identified in this task above
- Compare modeled and measured concentrations for the solid and vegetative/porous barrier cases
- Calculate model performance metrics such as bias, standard deviation, and geometric mean as functions of downwind distance, and meteorological parameters (stability, u-star, and wind speed)
- Perform model sensitivity to investigate the impact of gaps in vegetation barriers
- Develop parameterizations based on selected barrier parameters (e.g. geometry, porosity, vegetation type, and meteorology)
- Implement modifications to the barrier algorithm methodology into R-LINE using FORTRAN

Deliverable 8.1: The contractor shall provide a database of model inputs for the field studies to be evaluated (historical data)

Deliverable 8.2: The contractor shall provide model outputs for all model calculations

Deliverable 8.3: The contractor shall provide a description and model code for the vegetation barrier algorithm

Deliverable 8.4: The contractor shall provide a summary report of model vs. measurement results for the field studies evaluated that includes a list of field studies evaluated (including the work under this WA), model inputs used, comparison of performance metrics, and results from the sensitivity simulations.

Task 9. Air Quality Modeling: Mobile Monitoring Data to Assess the Sensitivity of Air Quality Modeled Concentrations to Emission Inventories

The objective of this task is to determine the requisite detail of emissions inventory data to ensure adequate data quality in modeled traffic-generated pollutant concentrations at receptors near roads, and to determine the computational demands in air quality modeling that are associated with various levels of emission data quality. The objectives of this task are to use mobile monitoring measurements to determine the sensitivity of air quality model results to various degrees of specificity in emissions inventory data, to understand how much detail is necessary to model near-road concentrations of traffic-generated pollutants accurately; and to determine the computational demands associated with various levels of specificity of emissions data to achieve reasonable comparisons to mobile monitoring and fixed site measurements. Extensive mobile monitoring data has been collected on light-rail trains and mobile monitoring vehicles in Salt Lake City. In addition, there is an extensive emissions inventory dataset (i.e., the Hestia

Formatted: No bullets or numbering

based model constructed for Salt Lake County, UT) that may prove useful for this assessment. The contractor may also identify other locations and datasets suitable for this analysis

This analysis shall focus on modeling near-road air quality at near-field receptors across large geographic areas (i.e., fine spatial resolution over large geographic extent).This sensitivity analysis shall include the following activities:

1) The contractor shall format dispersion model-ready emission inventories for PM2.5 and NOx for a large number of individual road segments within a large metropolitan area using two sets of data—a) a high-quality, "rich" data set and b) a parallel inventory, representing the same geographic location, to represent emission inventory data that would be considered typical of those developed for other large metropolitan areas (i.e., those developed by metropolitan planning organizations using their travel demand models). Emission inventories for explicit road links may be restricted to the areas near locations of ambient monitoring data, as described in subtask #2 below. Emission estimates outside these locations may be omitted or simplified if they do not have a substantial effect on concentrations at ambient monitoring locations.

2) The contractor shall create AERMOD input files based on the PM2.5 emission inventories using area source characterizations as described in Section 7 and Appendix J of EPA's *Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in PM2.5 and PM10 Nonattainment and Maintenance Areas* (hereafter, the "hot-spot guidance"). Dispersion modeling with AERMOD shall focus on the geographic areas within the metropolitan area where ambient monitoring data from mobile and fixed site measurements are available, and account for emission sources sufficiently close to monitoring locations to affect concentrations at those locations substantively. Other than the emissions inventories, the contractor shall use identical inputs to AERMOD for other factors, such as meteorological and receptor pathways. The contractor shall employ receptors that allow for characterization of spatial gradients around receptors with maximum concentrations. The contractor shall employ AERMOD consistent with EPA's hot-spot guidance and EPA's Guideline on Regulatory Air Models (Appendix W to 40 CFR Part 51). The contractor shall employ model averaging times consistent with the form of the relevant NAAQS (e.g., average and 6th-highest 24 hour average for PM2.5 using 5 years of off-site meteorological data).

3) The contractor shall evaluate the quality of modeled air quality data based on the two versions of the inventories, including comparisons to the available monitored ambient concentrations, using generally-accepted statistical and data-analytic methods.

The contractor shall design the model studies described in this task to determine, if possible, the minimum level of emissions data required to maintain acceptable data

quality in modeled concentrations. In particular, the contractor shall consider during the design of the study and recommend approaches to evaluate:

- Averaging time of emissions from individual road segments (e.g., hourly, periods as defined on page 33 of the hot-spot guidance, annual average).
- Use of aggregate emissions factors for all vehicles vs. separating light-duty and heavy-duty vehicles
- Inclusion or exclusion of road segments below a particular traffic volume threshold (e.g., AADT) or roadway functional classifications
- The length of meteorological record vs. shorter continuous periods or "sampled" days within the full record.

Formatted: Bulleted + Level: 1 + Aligned at: 0.28" + Indent at: 0.53"

Deliverable 9.1: The contractor shall provide for WACOR approval a modeling protocol to describe the purpose of the sensitivity analysis; how the analysis will be conducted, including how emissions inventories will be generated, and/or their source, the source of the input data in emissions inventories; how they compare to each other, the geographic area covered, the analysis year and other time information covered by the inventories, etc.; a description of how the emissions inventories differ from one another; and how air quality modeling will be conducted, including source characterization choices, meteorological data to be used, receptor placement, etc.

Deliverable 9.2: The contractor shall provide databases of the generated emission inventories, along with a memo that relates the databases to the description in the modeling protocol, noting any deviations from the modeling protocol. If MOVES is used to generate these inventories, this memo shall include detail about the run specification ("RunSpec") choices and the input database choices for each inventory as well as the source of the data for the input database.

Deliverable 9.3: The contractor shall provide model input files and outputs for all model calculations, i.e., for emissions modeling with MOVES, RunSpec files, and input and output databases; for air quality modeling with AERMOD, both the input and output files.

Deliverable 9.4: The contractor shall provide for WAM approval a summary report describing the sensitivity analyses, modeling procedures, and measurement data employed, including appropriate statistical, tabular, or graphical displays of information. The summary report can build on the modeling protocol from Deliverable 8b.1, with results and conclusions added.

Task 10. Mobile Monitoring Field Measurements: Near-Source Study in Memphis

The contractor shall conduct a 2-week mobile monitoring study in Memphis, Tennessee, during morning commute periods for CO2, NO2 and PM. The several hour mobile monitoring sessions shall be conducted at up to ~~three~~ five (~~3~~5)

locations in the Memphis area, to be determined by the WA COR, that will include the inland port area, airport, and highways. The storage and charging facility is anticipated to be made available by a local air monitoring agency partner as identified by the WA COR. The contractor shall provide trailer transportation to bring the car to and from the Memphis area, as well as from the storage/charging facility to and from each of the sampling locations. This study is anticipated to occur ~~directly after~~ in conjunction with the mobile monitoring field study in Oakland, California, so pre-study equipment evaluations will not be required. ~~In addition, t~~This work will be covered in the ~~vegetative barrier~~ QAPP for JTI WA1-039.

Deliverable 10.1: The contractor shall provide raw and quality-reviewed data to the WA COR within 60 days of sampling completion.

Deliverable 10.2: The contractor shall provide a report summarizing the results of the measurements in the Memphis study including sampler QA, estimated motor vehicle emission factors and assessment of the data trends

Task 11. Mobile Monitoring Field Measurements: Near-Source Study in Kansas City

The contractor shall conduct a mobile monitoring study for up to four (4) weeks in Kansas City, Kansas, for CO, CO2, NO2 and PM. The several hour mobile monitoring sessions shall be conducted in the vicinity of a large railyard, although also encompass measurements near highways and industrial facilities as determined by the WA COR. The vehicle will also be collocated at fixed sites installed and operated by EPA Region 7 in the vicinity of the railyard. The storage and charging facility is anticipated to be made available by a local air monitoring agency partner as identified by the WA COR. The contractor shall provide trailer transportation to bring the car to and from the Kansas City area, as well as from the storage/charging facility to and from each of the sampling locations. This study is part of a collaboration with EPA Region 7 and community groups that will include the fixed-site measurements and portable sensors. The mobile monitoring work described in this task will be covered in the QAPP under this separate JTI WA, which will include external peer review. The contractor will review this QAPP prior to the external peer review and after the EPA response to comments for approval and consistency. This field study is anticipated to be conducted in conjunction with the Oakland and Memphis studies to reduce vehicle and equipment shipping costs to the extent feasible and not require pre-study equipment evaluations.

Deliverable 11.1: The contractor shall provide raw and quality-reviewed data to the WA COR within 60 days of sampling completion.

Deliverable 11.2: The contractor shall provide a report summarizing the results of the measurements in the Kansas City study including sampler QA, estimated motor vehicle emission factors and assessment of the data trends

WA SPECIFIC EQUIPMENT

The contractor shall purchase (as Contractor Acquired Equipment) portable air quality sensors to measure the impacts of roadside vegetation barriers on downwind air quality. The contractor shall consult EPA experts on air quality sensors to recommend samplers for PM, BC and NO2 capable of providing measurements at ambient air concentrations to be expected near large roadways. Up to ~~five~~ eight (8~~5~~) sampling packs will be needed for this study. In addition, environmental monitoring shelters will need to be established for this project if not already provided by the manufacturer(s). These systems will utilize hand-held monitoring equipment and GPS capabilities into an integrated system capable of mapping spatial distributions of pollutant concentrations. The contractor shall also purchase equipment needed for calibration, maintenance and operation of the equipment identified in this WA including calibration gases, fittings, tubing, etc. The contractor shall obtain and operate Government Furnished Equipment as specified in this WA including air quality analyzers, the GMAP and SUV mobile monitoring vehicles, and select portable samplers.

QUALITY ASSURANCE

A QAPP has been approved for the chase vehicle field studies. The field sampling configurations and quality assurance requirements are described in an approved Category III QAPP which will be provided by the EPA WA COR with assistance from the contractor. The QAPP shall be applicable to the studies in both Oakland and Detroit. This QAPP shall be accompanied by a signature page that is signed by the Jacobs work assignment leader and QA officer to show that they have reviewed and approved the QAPP. It is the responsibility of the Jacobs work assignment leader to document this process. Upon receipt of the signed QAPP, the EPA work assignment manager and QA manager will review and approve the QAPP and they will add their signatures to the signature page. Work involving environmental data shall not commence until the QAPP has received official approval from the EPA Quality Assurance Staff.

DELIVERABLES WITH SCHEDULE

Deliverable 2.1: Contractor shall submit an updated GMAP vehicle safety plan for ~~the~~ all field ~~study~~ studies to the EPA WA COR prior to initiating field measurements and provide general vehicle support. If applicable, the plan developed for this option period can be used for this field study (at least 30 days prior to field study)

Deliverable 2.2: Contractor shall provide a signed agreement for technical support from the GMAP vehicle manufacturer through at least three months after the

proposed completion date for this project in the contractor's project workplan, to be completed prior to initiating field measurements. This agreement shall include in-person support during domestic deployments. If applicable, the agreement developed for this option period can be used for this field study (at least 30 days prior to field study)

Deliverable 2.3: Contractor shall provide a safe, working GMAP vehicle equipped with instruments required under this work assignment, including making any repairs and improvements needed to the GMAP vehicle to fully implement the field studies (at least 30 days prior to field study)

Deliverable 3.1: The contractor shall provide raw time-stamped inter-comparison data to the EPA WA COR, within one week of sampling completion for the RTP study (anticipate study in December, 2016 pending GMAP repairs completed 1 month prior)

Deliverable 4.1: The contractor shall provide raw time-stamped chase study data to the EPA WA COR, within one week of sampling completion for the RTP study.

Deliverable 4.2: The contractor shall provide a report summarizing the results of the measurements in the RTP study including sampler QA, estimated motor vehicle emission factors and assessment of the chase method within 8 weeks of study completion

Deliverable 5.1: Contractor shall submit an updated SOP for the use of the portable air quality sensors sampling systems for use in Oakland and Detroit to the EPA WA COR prior to initiating field measurements. If applicable, the SOP developed for this option period can be used for this field study.

Deliverable 5.2: The contractor shall provide raw time-stamped and statistically analyzed (scatterplots, correlation coefficients) inter-comparison data to the EPA WA COR, within ~~two~~ four weeks of sampling completion.

Deliverable 6.1: The contractor shall provide raw time-stamped and statistically analyzed (scatterplots, correlation coefficients) inter-comparison data to the EPA WA COR, within two weeks of sampling completion. (anticipate Detroit study in Oct/Nov, 2016 pending planting completion in Oct; Oakland study in Jan/Feb pending planting in Oct/Nov/Dec)

Deliverable 6.2: The contractor shall provide a report for the Oakland, California measurement campaigns comparing the mobile monitoring measurements with the GMAP, Google and California ARB mobile monitoring vehicles include the methods used in the study, data analysis of the measurements collected, and trends from the analysis for data collected. This could be a separate report or combined with the report for Deliverable 7.3 under Task 7

Deliverable 7.1: The contractor shall provide raw time-stamped concentration and meteorological data from the four ~~, 2-week~~ studies, two in Oakland, California and

two in Detroit, Michigan, to the EPA WA COR (e.g. upload to a shared file folder or e-mailed to the EPA WA COR) within 3 days of data collection. The data to be reported and formatting will be described in the QAPP. (anticipate pre-sampling studies in Oakland and Detroit in April/May, 2016; Detroit post-planting study in Oct/Nov, 2016 pending planting completion in Oct; Oakland post-planting study in Jan/Feb, 2017 pending planting in Oct/Nov/Dec)

Deliverable 7.2: The contractor shall provide a complete data package (DP) for the each of the four ~~, 2-week~~ roadside vegetation studies, two in Oakland, California and two in Detroit, Michigan within 4 weeks of field monitoring completion. The DP shall include field notes, quality-assured field data, in-field quality indicators, calibration checks (to be outlined in the QAPP), and video. No contractor-generated report will be required as a deliverable. This DP will include data collected in Tasks 6 and 7

Deliverable 7.3: The contractor shall provide a report for the two Oakland, California measurement campaigns detailing the methods used in the study, data analysis of the measurements collected, and trends from the analysis for data collected under Tasks 6 and 7 within 10 weeks of field monitoring completion for the second, post-planting field study

Deliverable 7.4: The contractor shall provide a report for the two Detroit, Michigan measurement campaigns detailing the methods used in the study, data analysis of the measurements collected, and trends from the analysis for data collected under Tasks 6 and 7 within 10 weeks of field monitoring completion for the second, post-planting field study

Deliverable 7.5: The contractor shall submit a summary of how the results from the Oakland and Detroit field studies could be used to design and assess the benefits of using roadside vegetation for walking and biking paths along busy roads, including a comparison with a case study

Deliverable 8.1: The contractor shall provide a database of model inputs for the field studies to be evaluated based on historical data (within 60 days of project initiation)

Deliverable 8.2: The contractor shall provide model outputs for all model calculations (within 90 days of Deliverable 8.1)

Deliverable 8.3: The contractor shall provide a description and model code for the vegetation barrier algorithm (within 300 days of Deliverable 8.1)

Deliverable 8.4: The contractor shall provide a summary report of model vs. measurement results for the field studies evaluated that includes a list of field studies evaluated (including the work under this WA), model inputs used, comparison of performance metrics, and results from the sensitivity simulations (within 300 days of Deliverable 8.1)

Deliverable 9.1: The contractor shall provide for WACOR approval a modeling protocol to describe the purpose of the sensitivity analysis; how the analysis will be conducted, including how emissions inventories will be generated, and/or their source, the source of the input data in emissions inventories; how they compare to each other, the geographic area covered, the analysis year and other time information covered by the inventories, etc.; a description of how the emissions inventories differ from one another; and how air quality modeling will be conducted, including source characterization choices, meteorological data to be used, receptor placement, etc. (within 30 days of amended workplan approval)

Deliverable 9.2: The contractor shall provide databases of the generated emission inventories, along with a memo that relates the databases to the description in the modeling protocol, noting any deviations from the modeling protocol. If MOVES is used to generate these inventories, this memo shall include detail about the run specification ("RunSpec") choices and the input database choices for each inventory as well as the source of the data for the input database. (by March, 2017)

Deliverable 9.3: The contractor shall provide model input files and outputs for all model calculations, i.e., for emissions modeling with MOVES, RunSpec files, and input and output databases; for air quality modeling with AERMOD, both the input and output files. (by March, 2017)

Deliverable 9.4: The contractor shall provide for WAM approval a summary report describing the sensitivity analyses, modeling procedures, and measurement data employed, including appropriate statistical, tabular, or graphical displays of information. The summary report can build on the modeling protocol from Deliverable 8b.1, with results and conclusions added. (by March, 2017)

Deliverable 10.1: The contractor shall provide raw and quality-reviewed data to the WA COR within 60 days of sampling completion. (anticipate study in Jan/Feb/Mar, 2017 pending Oakland post-planting study occurs in Jan/Feb, 2017)

Deliverable 10.2: The contractor shall provide a report summarizing the results of the measurements in the Memphis study including sampler QA, estimated motor vehicle emission factors and assessment of the data trends

Deliverable 11.1: The contractor shall provide raw and quality-reviewed data to the WA COR within 60 days of sampling completion. (anticipate study in Jan/Feb/Mar, 2017 pending Oakland post-planting study occurs in Jan/Feb, 2017, EPA approves the project QAPP, and EPA Region 7 installs fixed-site monitors prior to this date)

Deliverable 11.2: The contractor shall provide a report summarizing the results of the measurements in the Kansas City study including sampler QA, estimated motor vehicle emission factors and assessment of the data trends

ATTACHMENT #1 TO THE STATEMENT OF WORK (SOW)

FOR MEASUREMENT PROJECTS

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD (mark all that apply):

- ☐ **NRMRL's Quality System Specifications:**

  (1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

  (2) an organizational chart showing the position of the QA function;

  (3) delineation of the authority and responsibilities of the QA function;

  (4) the background and experience of the QA personnel who will be assigned to the project; and

  (5) the organization's general approach for accomplishing the QA specifications in the SOW.

- ☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,

  http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

- ☐ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function; 07/14/08 A-2

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

- ☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,

  http://www.epa.gov/quality/qs-docs/r2-final.pdf

- ☐ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X **QAPP Requirements for Measurement Projects**

☐ **QAPP Requirements for Secondary Data Projects**

☐ **QAPP Requirements for Research Model Development and/or Application Projects**

☐ **QAPP Requirements for Software Development Projects**

☐ **QAPP Requirements for Method Development Projects**

☐ **QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/

EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

---

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.

1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.

2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.

3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.

3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.

4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.

4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.

4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.

4.5 Describe the method for uniquely numbering each sample.

4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5 MEASUREMENT PROCEDURES

5.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.

5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6 QUALITY METRICS (QA/QC CHECKS)

6.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

6.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7 DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

7.2 Describe data validation procedures used to ensure the reporting of accurate project data.

7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).

7.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

7.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

7.4 Describe data storage requirements for both hard copy and electronic data.

8 REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA	United States Environmental Protection Agency Washington, DC 20460 **Work Assignment**	Work Assignment Number 1-026 ☐ Other ☒ Amendment Number: 000002

Contract Number	Contract Period 04/01/2015 To 03/31/2018 Base Option Period Number 1	Title of Work Assignment/SF Site Name
EP-C-15-008		Mobile monitoring

Contractor	Specify Section and paragraph of Contract SOW
JACOBS TECHNOLOGY INC.	4

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:
The purpose of this amendment is to revise the PWS (see track changes) and change the Alternate WACOR to Chad Bailey.

☐ Superfund — **Accounting and Appropriations Data** — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2018 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee — LOE:

Cumulative Approved: — Cost/Fee — LOE:

Work Assignment Manager Name Richard Baldauf	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-4386 FAX Number:
Project Officer Name Robin S. Harris	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-0955 FAX Number:
Other Agency Official Name	(Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Candice Charlton	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2007 FAX Number:

Performance Statement of Work

WA Title: Mobile monitoring air pollution characterization

WA Title Descriptor: Mobile monitoring to quantify motor vehicle emissions, near source, and roadside vegetation effects on near-road air quality

WA #: 1-026 WACOR: Rich Baldauf

Contract #: EP-C-15-008 Alternate WACOR: Chad Bailey

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

This work assignment will focus on ~~two~~ three primary objectives:

1. Development of methods to use mobile monitoring as a chase vehicle to determine motor vehicle emission rates; conduct pilot studies in US and China
2. Use mobile and portable monitoring techniques to quantify how roadside vegetation can mitigate near-road air quality, including development of dispersion model algorithms
3. Use mobile monitoring to assess impacts from motor vehicles and other sources (rail, industrial) to understand community impacts and evaluate modeling and data analysis techniques for local and national applications

BACKGROUND

Recent research by the EPA shows how mobile monitoring can be used to assess motor vehicle emissions and impacts on near-road and near-source air quality. The use of mobile monitoring for vehicle emissions studies can provide a method to obtain large-scale emissions factors under real-world driving conditions. This type of technique can be especially important to obtaining emission factors in areas with little data for local emission inventories. This technique has applications for US cities as well as developing countries.

To mitigate the growing public health concerns on near-road exposures to traffic emissions, roadway design, including the presence of vegetation, has been shown to alter concentrations of traffic-generated pollutants away from the road. Field study measurements have been collected under previous studies to determine

associations among vegetation and near-road air quality. In addition, studies have been conducted quantifying how solid barriers affect near-road pollutant transport and dispersion. From these studies, model algorithms have been developed. In addition, these model algorithms have also been evaluated for potential use in describing near-road pollutant transport in the presence of vegetation barriers. The goal of this project is to evaluate and refine the vegetation model algorithm through collection of independent field data and comparing the RLINE model algorithm. Mobile monitoring will also be used to understand the impacts of different sources on local and regional air quality, including transportation-related sources like river ports, airports, and highways.

SCOPE

The contractor shall help develop methods of using an electric mobile monitoring vehicle as a chase platform to obtain motor vehicle emissions factors. This will include the supervision and training of Chinese researchers (collaborators under the EPA ORD/China Ministry of Science & Technology MOU) on the inclusion and alignment of analyzers and sampling ports on an electric vehicle, as well as supervise the development of analytical and testing strategies to optimize measurement procedures. The contractor shall supervise the Chinese researchers in conducting a field study lasting six (6) weeks in Beijing and Zhangjiakou, China to measure particulate matter (PM), nitrogen dioxide (NO_2), and carbon dioxide (CO2) to obtain motor vehicle emission rates. The contractor will not operate the vehicle in China, but will supervise and assist in the shipping of equipment, vehicle preparation, equipment operation, and data analysis.

The contractor shall also use the electric vehicle monitoring platform and portable air quality sensors to investigate the impact of roadside vegetation on nearby air quality. This project will consist of participating in planning meetings, site location identification, assisting EPA staff in the design of roadside vegetation barriers, sampling air quality before and after the construction of a roadside vegetation barrier in Oakland, CA and Detroit, MI, and training state and local personnel on the operation of the portable sensors. Two field studies lasting for two (2) weeks each will be conducted before and after construction of the vegetative barrier in each city (total of four (4) field studies). Measurements will include particulate matter (PM), nitrogen dioxide (NO_2), and carbon monoxide (CO) near a large highway with and without roadside vegetation. These studies will include the deployment of air quality sensors, as well as mobile monitoring vehicles equipped with air monitoring and meteorology equipment. The all-electric vehicle shall be deployed to conduct real-time measurements of PM, NO_2, and CO. An SUV equipped with similar PM, NO_2, and CO instruments may also be parked and sample at a fixed location using an on-board battery pack system. The SUV sampling location will also include meteorological measurements, and may be moved during the study. The SUV may also be equipped with a mast to allow pollutant and meteorological measurements

at differing heights above ground. Four (4) or more portable air quality sensor packages for PM and NO_2 will also be developed and installed at fixed locations along the vegetation barrier and clearing areas.

The roadside vegetation monitoring data will be compared to modeling results using algorithms and techniques developed to assess air pollutant transport and dispersion in the presence of solid and vegetative roadside barriers under previous WAs. The vegetative barrier algorithm will be modified as needed based on the results of the field study and consultation with the EPA WA COR. In addition to the use of the field study data, the algorithm evaluation may also require the evaluation of other data from CFD modeling and wind tunnel studies done under separate WAs and projects.

The contractor will also use mobile monitoring to assess the impacts of various source types on local and regional air quality. The contractor will collect air quality samples over multiple monitoring routes that are impacted by different sources including railyards, river port activities, airport activities, highways and industrial facilities in complex urban areas that will also be collecting fixed-site air quality data using portable sensor networks.

The contractor shawill also evaluate how mobile and fixed-site monitoring can be used to assess mobile source emission inventories and models to identify and assess techniques for using these models to conduct national-scale assessments on the impacts of emission control and other pollution mitigation strategies on human health and air quality benefits.

TECHNICAL APROACH/OBJECTIVES

Task 1. Site Selection and Preparation: Chase and Vegetative Barrier Studies

The contractor shall recommend driving routes in the Beijing and Zhangjiakou areas for conducting the chase study. The contractor shall visit the selected monitoring sites in coordination with EPA and Chinese personnel as required for the purpose of evaluating field sampling deployments and provide recommendations on final route selection. Final site selection will be determined by the EPA WA COR in consultation with the Chinese researchers. For the chase study in China, EPA and contractor personnel will advise Chinese collaborators in determining an initial appropriate site location, which will be done remotely and not require a separate trip to China for this purpose.

~~The contractor shall also conduct field sampling the Research Triangle Park, North Carolina area using similar techniques and methods used in the China studies. The contractor shall develop and improve based on lessons learned from the China field studies to improve the chase vehicle methodology and obtain emission factor estimates from on-road US vehicles. The contractor shall also work with EPA to~~

Formatted: Strikethrough

~~conduct chase studies of vehicles equipped with PEMS units under a separate EPA work assignment~~

The contractor shall also provide recommendations and support in the selection of mobile and fixed site locations for conducting the vegetation barrier studies in Oakland and Detroit. This support may include identifying potential sites using on-line mapping and photography programs and reviewing recommendations by the EPA WA COR and EPA Region 9 staff. The final site selection will be provided by the EPA WA COR. While the project is leveraging tree planting from other organization's grants, the contractor will need to purchase and plant some vegetation in order to develop a barrier suitable for air quality benefits.

Task 2. Technical and Safety Support for the Electric Vehicle and SUV: ~~Chase and Vegetative Barrier~~All Studies

The GMAP vehicle is an electric car specially customized to support onboard sampling. Given its limited driving range and specialized design, contractor support shall provide general vehicle support and vehicle transportation to field sites. The contractor shall update and implement the safety plan for field deployment activities involving the GMAP vehicle as well as the SUV used for both GMAP transport and field sampling. The safety plan was developed for previous studies, and includes emergency response protocols in the event that the GMAP vehicle loses power while driving on a highway or arterial road. In addition, a multi-year technical support agreement is in place to ensure that the vehicle manufacturer will provide on-site troubleshooting in the event of significant vehicle performance issues during a field campaign. Due to the age of the existing GMAP vehicle, the contractor may also need to install and equip the measurement instruments in a new electric vehicle platform. This will include equipment installation, power hookups, and safety measures. Prior to the start of field study preparation, the WACOR will inform the contractor which platform will be used. The level of effort is anticipated to be the same regardless of whether the existing GMAP or a new vehicle is used for the mobile monitoring studies.

Deliverable 2.1: Contractor shall submit an updated GMAP vehicle safety plan for ~~the~~ all field ~~study~~ studies to the EPA WA COR prior to initiating field measurements and provide general vehicle support. If applicable, the plan developed for this option period can be used for this field study.

Deliverable 2.2: Contractor shall provide a signed agreement for technical support from the GMAP vehicle manufacturer through at least three months after the proposed completion date for this project in the contractor's project workplan, to be completed prior to initiating field measurements. This agreement shall include in-person support during domestic deployments. If applicable, the agreement developed for this option period can be used for this field study.

Deliverable 2.3: Contractor shall provide a safe, working GMAP vehicle equipped with instruments required under this work assignment, including making any

repairs and improvements needed to the GMAP vehicle to fully implement the field studies

Task 3. Mobile Monitoring Instrumentation Support: Chase Study

The contractor shall conduct mobile monitoring instrumentation support activities prior to deployment to the field, including measurement inter-comparison tests, instrument calibration and maintenance, and development work to improve measurement accuracy. These work activities include, but are not limited to, inter-comparison activities for a one-week period of monitoring instrumentation sampling while on-board the mobile monitoring vehicles in motion and during fixed sampling. During this activity, the contractor shall supervise the Chinese researchers in instrument operation and evaluation.

Deliverable 3.1: The contractor shall provide raw time-stamped inter-comparison data to the EPA WA COR, within one week of sampling completion for the China study.

Task 4. Field Measurements: Chase Study

The contractor shall supervise and assist a six-week field monitoring study over consecutive weeks, at locations and driving routes to be determined in the Beijing and Zhangjiakou ~~Nanjing~~ areas under task 1 to measure motor vehicle exhaust emission rates using an electric vehicle in a chase mode. The contractor will supervise the shipment of EPA equipment to Tsinghua University in Beijing, China. The contractor will supervise the installation, calibration, operation, and maintenance of EPA instruments in the Chinese electric vehicle used for sampling. The contractor will also assist in data collection and analysis from the instruments. All on-road operations of the electric vehicle will be conducted by the Chinese researchers. An approved Category III QAPP has been completed for this study. In the event that inclement weather or other unavoidable circumstances prevent field sampling, a sampling day may be cancelled and rescheduled to meet the target of 30 sampling days for the studies.

~~The contractor shall lead a two-week study in the Research Triangle Park, North Carolina area to measure NO2, CO2, BC and UFP emissions using the methods developed during the China study. The contractor shall implement the China study protocol and make recommendations for improvements in the methodology based on lessons learned in China. For a portion of the time, the electric vehicle will follow a vehicle equipped with a PEMS unit as part of a separate EPA work assignment~~

Formatted: Strikethrough

~~Deliverable 4.1: The contractor shall provide raw time-stamped chase study data to the EPA WA COR, within one week of sampling completion for the RTP study.~~

~~Deliverable 4.2: The contractor shall provide a report summarizing the results of the measurements in the RTP study including sampler QA, estimated motor vehicle~~

~~emission factors and assessment of the chase method within 8 weeks of study completion~~

Task 5. Technical Support for the Portable Sensors: Vegetative Barrier Study

The contractor shall recommend, purchase (as Contractor Acquired Equipment), and operate portable air quality sensors to measure the impacts of roadside vegetation barriers on downwind air quality. The contractor shall consult EPA experts on air quality sensors to recommend samplers for PM, BC and NO2 capable of providing measurements at ambient air concentrations to be expected near large roadways. Up to ~~five~~ eight (~~8~~5) sampling packs will be needed for this study. In addition, environmental monitoring shelters with power (battery and/or solar) will need to be established for this project if not already provided by the manufacturer(s). These systems will utilize hand-held monitoring equipment and GPS capabilities into an integrated system capable of mapping spatial distributions of pollutant concentrations. Contractor support shall include general equipment support and transportation/shipment to the field sites. The contractor shall update and implement the standard operating procedures (SOP) for field deployment involving these systems. The SOPs include equipment descriptions and operations, instrument setup and maintenance, instrument calibration and maintenance, data storage, and data retrieval. The contractor shall also conduct a one-week, inter-comparison study of the samplers to determine the accuracy and precision of the samplers. Accuracy and precision will be assessed by collocation of all sensors at the Raleigh Near-Road Monitoring Station for a minimum of two-weeks. As part of this study, the contractor shall provide support in converting raw data files from the sampling instruments into Excel spreadsheets. Contractor support shall also adhere to applicable Quality Assurance Project Plans (QAPPs).

Deliverable 5.1: Contractor shall submit an updated SOP for the use of the portable air quality sensors sampling systems for use in Oakland and Detroit to the EPA WA COR prior to initiating field measurements. If applicable, the SOP developed for this option period can be used for this field study.

Deliverable 5.2: The contractor shall provide raw time-stamped and statistically analyzed (scatterplots, correlation coefficients) inter-comparison data to the EPA WA COR, within ~~two~~ four weeks of sampling completion.

Task 6. Mobile Monitoring Field Measurements: Vegetative Barrier Study

The contractor shall conduct mobile monitoring instrumentation support activities prior to deployment to the field, including measurement inter-comparison tests, instrument calibration and maintenance, and development work to improve measurement accuracy. These work activities include, but are not limited to, inter-comparison activities for a minimum of one-week ~~period~~ of monitoring instrumentation sampling while on-board the mobile monitoring vehicles in motion and during fixed sampling.

The contractor shall conduct ~~two~~ one mobile monitoring field study~~ies~~ for a ~~two~~four-five week period in ~~both~~ the Oakland, California ~~and Detroit, Michigan~~bay area. ~~After the planting has been completed, a measurement campaign will be conducted for a four-week period at each city. The vegetation planting will be conducted by external partners in each city, so the start dates of the field studies will be contingent on the completion of the vegetation barrier planting.~~ The EPA will provide the contractor with a notice of at least 1 month so there is sufficient time to prepare for the study once the planting has occurred. The field study will collect mobile monitoring data for a minimum of CO2, NO2, and PM in the vicinity of the vegetative barrier plantings ~~in each city~~. The mobile route shall include behind the barrier, behind the clearing, multiple distances from the highway, and on the highway. The route will be selected as part of Task 1. This monitoring will be done in conjunction with the portable sensor monitoring described in Task 7. ~~For the study measurements in Detroit, the contractor shall include a vehicle following the GMAP to insure safety of the driver and equipment.~~

Formatted: Strikethrough

Formatted: Strikethrough

As part of the post-planting mobile monitoring field studies, the vehicle will be placed parked next to a state run NAAQS monitoring site at the beginning of each week for an approximately 2-hour time period for comparison with the regulatory monitoring values. There is a state-run NAAQS monitoring station within approximately 5 km of ~~each~~ the site. The contractor shall work with the respective state to obtain the monitoring data for the time periods of collocated measurements. In addition to the mobile monitoring vehicle, the contractor shall also place the portable sensors used in Task 7 at the NAAQS station for the same time periods in order to obtain collocated data for all measurement equipment.

In Oakland, the EPA anticipates that other mobile monitoring vehicles will be operating at the site by Google and the California Air Resources Board. The contractor shall collocate the GMAP vehicle with these other mobile monitoring vehicles for a minimum of 30-minutes each sampling day. The contractor shall also coordinate driving routes and sampling times as needed with these project partners.

The contractor shall also conduct mobile measurements for a minimum of three days in Woodside and Palo Alto, CA. These were previously monitored sites by the EPA in 2014. The contractor shall follow the QAPP "Mobile Monitoring to Quantify the Impacts of Roadside Vegetation on Near-Road Air Quality" approved under Arcadis WA5-40 for this project. For the Woodside, CA portion of the project, the contractor shall only perform the mobile stationary sampling, with the SUV parked at the clearing and the electric GMAP vehicle stopped at each of the fixed-site locations for an approximately 10-minute time period. The contractor shall do three rotations for an approximately 3-hour sampling day during morning rush hour. For Palo Alto, the contractor shall also only perform the fixed site monitoring, with the SUV parked in the clearing and the electric GMAP vehicle behind the vegetation barrier closest to the clearing for an approximately 3-hour sampling day.

Formatted: Font: Not Bold

For both studies, the SUV video will be configured to capture traffic on both the highway and the access road.

Deliverable 6.1: The contractor shall provide raw time-stamped and statistically analyzed (scatterplots, correlation coefficients) inter-comparison data to the EPA WA COR, within two weeks of sampling completion.

Deliverable 6.2: The contractor shall provide a report for the Oakland, California area measurement campaigns comparing the mobile monitoring measurements with the GMAP, Google and California ARB mobile monitoring vehicles including the methods used in the study, data analysis of the measurements collected, and trends from the analysis for data collected. This could be a separate report or combined with the report for Deliverable 7.3 under Task 7

Task 7. Portable Sensors Field Measurements: Vegetative Barrier Study

The contractor shall conduct four~~, 2-week~~ field monitoring studies as described in Task 6: two in Oakland, California prior to and after the construction of a roadside vegetation barrier by external partners at the respective monitoring site locations identified under Task 1and ~~two~~ one each in ~~Detroit, Michigan~~ Woodside and Palo Alto, Californiaprior to and after the construction of a roadside vegetation barrier at the respective monitoring site locations identified under Task 1. The study will consist of the deployment of the portable, air quality sensors and meteorological monitoring equipment at the study location. The equipment will all be operated within an approximately 500m-by-500m square area prior to and after the vegetative barrier construction. Some samplers may be required at different heights above ground, requiring a stand for sampler deployment. The contractor shall conduct pre- and post-sampling maintenance and calibration of all samplers as outlined in the SOP. The contractor shall also set-up and maintain sampler operation in the field, and store and collect all measurement data. Two sets of samplers and sonic anemometer meteorological equipment may also be located on a mast to collect data at multiple heights above ground. In addition to the collection of air monitoring data, the contractor shall also document roadway properties including terrain, nearby vegetation and other structures, and location and characteristics of the monitoring sites. The contractor shall also collect video of highway and any adjacent road activities in the vicinity of the site during data collection. The field sampling campaigns will be manned with personnel having expertise and experience on portable and mobile monitoring sampling field applications sufficient to ensure a minimum 80% completeness Data Quality Objective, as described in the QAPP, and provide future training to state and local partners in the study. The field sampling configurations and quality assurance requirements are described in an approved Category III QAPP which will be provided by the EPA WA COR with assistance from the contractor. The QAPP shall be applicable to the studies in both Oakland and Detroit. This QAPP shall be accompanied by a signature page that is signed by the Jacobs work assignment leader and QA officer to show that they have reviewed and approved the QAPP. It

is the responsibility of the Jacobs work assignment leader to document this process. Upon receipt of the signed QAPP, the EPA work assignment manager and QA manager will review and approve the QAPP and they will add their signatures to the signature page. Work involving environmental data shall not commence until the QAPP has received official approval from the EPA Quality Assurance Staff. In the event that inclement weather or other unavoidable circumstances prevent field sampling, a sampling day may be cancelled and rescheduled to meet the target of 20 sampling days for the study.

Deliverable 7.1: The contractor shall provide raw time-stamped concentration and meteorological data from the four~~, 2-week~~ studies, two in Oakland, California and one each in Woodside and Palo Alto, California~~Detroit, Michigan~~, to the EPA WA COR (e.g. upload to a shared file folder or e-mailed to the EPA WA COR) within 3 days of data collection. The data to be reported and formatting will be described in the QAPP.

Deliverable 7.2: The contractor shall provide a complete data package (DP) for the each of the four~~, 2-week~~ roadside vegetation studies, two in Oakland, California and one each in Woodside and Palo Alto, California~~Detroit, Michigan~~ within 4 weeks of field monitoring completion. The DP shall include field notes, quality-assured field data, in-field quality indicators, calibration checks (to be outlined in the QAPP), and video. No contractor-generated report will be required as a deliverable. This DP will include data collected in Tasks 6 and 7

Deliverable 7.3: The contractor shall provide a report for the Oakland, California area measurement campaigns detailing the methods used in the study, data analysis of the measurements collected, and trends from the analysis for data collected under Tasks 6 and 7 within 10 weeks of field monitoring completion for the second, post-planting field study

~~Deliverable 7.4: The contractor shall provide a report for the two Detroit, Michigan measurement campaigns detailing the methods used in the study, data analysis of the measurements collected, and trends from the analysis for data collected under Tasks 6 and 7 within 10 weeks of field monitoring completion for the second, post-planting field study~~

Formatted: Strikethrough

~~Deliverable 7.5: The contractor shall submit a summary of how the results from the Oakland and Detroit field studies could be used to design and assess the benefits of using roadside vegetation for walking and biking paths along busy roads, including a comparison with a case study~~

Task 8. Air Quality Modeling: Vegetative Barrier Study

The contractor shall use the results of previous field measurements around vegetation barriers (collected under previous WAs) to develop and evaluate a dispersion model algorithm for estimating the impacts of vegetative barriers on near roadway air pollutants. Based on results of the evaluation, the contractor shall modify model algorithms to account for the effects of vegetative barriers to

assist with the design and evaluation of the constructed barriers in Oakland and Detroit.

The contractor shall also implement the vegetation barrier algorithm into the R-LINE model, test it, make modifications as necessary, and compare model results with field study data as follows:

- Prepare model inputs (including source configurations, meteorological characterizations and model receptors) for simulating the test periods of vegetative/porous barrier field measurements, including but not limited to the following near-roadway studies: Wind Tunnel (data will be provided by EPA), Mebane (data will be provided by EPA), Chapel Hill (data will be provided by EPA), Detroit (collected under WA2-40) and the California field study (collected under WA5-40).
- Perform model simulations using dispersion models selected for this study (e.g. R-LINE, CTAG) and the inputs for the studies identified in this task above
- Process model output files for comparison with field measurements from the studies identified in this task above
- Compare modeled and measured concentrations for the solid and vegetative/porous barrier cases
- Calculate model performance metrics such as bias, standard deviation, and geometric mean as functions of downwind distance, and meteorological parameters (stability, u-star, and wind speed)
- Perform model sensitivity to investigate the impact of gaps in vegetation barriers
- Develop parameterizations based on selected barrier parameters (e.g. geometry, porosity, vegetation type, and meteorology)
- Implement modifications to the barrier algorithm methodology into R-LINE using FORTRAN

Deliverable 8.1: The contractor shall provide a database of model inputs for the field studies to be evaluated (historical data)

Deliverable 8.2: The contractor shall provide model outputs for all model calculations

Deliverable 8.3: The contractor shall provide a description and model code for the vegetation barrier algorithm

Deliverable 8.4: The contractor shall provide a summary report of model vs. measurement results for the field studies evaluated that includes a list of field

studies evaluated (including the work under this WA), model inputs used, comparison of performance metrics, and results from the sensitivity simulations.

Task 9. Air Quality Modeling: Mobile Monitoring Data to Assess the Sensitivity of Air Quality Modeled Concentrations to Emission Inventories

The objective of this task is to determine the requisite detail of emissions inventory data to ensure adequate data quality in modeled traffic-generated pollutant concentrations at receptors near roads, and to determine the computational demands in air quality modeling that are associated with various levels of emission data quality. The objectives of this task are to use mobile monitoring measurements to determine the sensitivity of air quality model results to various degrees of specificity in emissions inventory data, to understand how much detail is necessary to model near-road concentrations of traffic-generated pollutants accurately; and to determine the computational demands associated with various levels of specificity of emissions data to achieve reasonable comparisons to mobile monitoring and fixed site measurements. Extensive obile monitoring data has been collected on light-rail trains and mobile monitoring vehicles in Salt Lake City. In addition, there is an extensive emissions inventory dataset (i.e., the Hestia based model constructed for Salt Lake County, UT) that may prove useful for this assessment. The contractor may also identify other locations and datasets suitable for this analysis

Formatted: No bullets or numbering

This analysis shall focus on modeling near-road air quality at near-field receptors across large geographic areas (i.e., fine spatial resolution over large geographic extent).This sensitivity analysis shall include the following activities:

1) The contractor shall format dispersion model-ready emission inventories for PM2.5 and NOx for a large number of individual road segments within a large metropolitan area using two sets of data—a) a high-quality, "rich" data set and b) a parallel inventory, representing the same geographic location, to represent emission inventory data that would be considered typical of those developed for other large metropolitan areas (i.e., those developed by metropolitan planning organizations using their travel demand models). Emission inventories for explicit road links may be restricted to the areas near locations of ambient monitoring data, as described in subtask #2 below. Emission estimates outside these locations may be omitted or simplified if they do not have a substantial effect on concentrations at ambient monitoring locations.

2) The contractor shall create AERMOD input files based on the PM2.5 emission inventories using area source characterizations as described in Section 7 and Appendix J of EPA's *Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in PM2.5 and PM10 Nonattainment and Maintenance Areas* (hereafter, the "hot-spot guidance"). Dispersion modeling with AERMOD shall focus on the geographic areas within the metropolitan area where ambient monitoring data from mobile and fixed site measurements are

available, and account for emission sources sufficiently close to monitoring locations to affect concentrations at those locations substantively. Other than the emissions inventories, the contractor shall use identical inputs to AERMOD for other factors, such as meteorological and receptor pathways. The contractor shall employ receptors that allow for characterization of spatial gradients around receptors with maximum concentrations. The contractor shall employ AERMOD consistent with EPA's hot-spot guidance and EPA's Guideline on Regulatory Air Models (Appendix W to 40 CFR Part 51). The contractor shall employ model averaging times consistent with the form of the relevant NAAQS (e.g., average and 6th-highest 24 hour average for PM2.5 using 5 years of off-site meteorological data).

3) The contractor shall evaluate the quality of modeled air quality data based on the two versions of the inventories, including comparisons to the available monitored ambient concentrations, using generally-accepted statistical and data-analytic methods.

The contractor shall design the model studies described in this task to determine, if possible, the minimum level of emissions data required to maintain acceptable data quality in modeled concentrations. In particular, the contractor shall consider during the design of the study and recommend approaches to evaluate:

- Averaging time of emissions from individual road segments (e.g., hourly, periods as defined on page 33 of the hot-spot guidance, annual average).
- Use of aggregate emissions factors for all vehicles vs. separating light-duty and heavy-duty vehicles
- Inclusion or exclusion of road segments below a particular traffic volume threshold (e.g., AADT) or roadway functional classifications
- The length of meteorological record vs. shorter continuous periods or "sampled" days within the full record.

Formatted: Bulleted + Level: 1 + Aligned at: 0.28" + Indent at: 0.53"

Deliverable 9.1: The contractor shall provide for WACOR approval a modeling protocol to describe the purpose of the sensitivity analysis; how the analysis will be conducted, including how emissions inventories will be generated, and/or their source, the source of the input data in emissions inventories; how they compare to each other, the geographic area covered, the analysis year and other time information covered by the inventories, etc.; a description of how the emissions inventories differ from one another; and how air quality modeling will be conducted, including source characterization choices, meteorological data to be used, receptor placement, etc.

Deliverable 9.2: The contractor shall provide databases of the generated emission inventories, along with a memo that relates the databases to the description in the modeling protocol, noting any deviations from the modeling protocol. If MOVES is used to generate these inventories, this memo shall include detail about the run

specification ("RunSpec") choices and the input database choices for each inventory as well as the source of the data for the input database.

Deliverable 9.3: The contractor shall provide model input files and outputs for all model calculations, i.e., for emissions modeling with MOVES, RunSpec files, and input and output databases; for air quality modeling with AERMOD, both the input and output files.

Deliverable 9.4: The contractor shall provide for WAM approval a summary report describing the sensitivity analyses, modeling procedures, and measurement data employed, including appropriate statistical, tabular, or graphical displays of information. The summary report can build on the modeling protocol from Deliverable 8b.1, with results and conclusions added.

~~Task 10. Mobile Monitoring Field Measurements: Near-Source Study in Memphis~~

Formatted: Strikethrough

~~The contractor shall conduct a 2-week mobile monitoring study in Memphis, Tennessee, during morning commute periods for CO2, NO2 and PM. The several hour mobile monitoring sessions shall be conducted at up to three five (53) locations in the Memphis area, to be determined by the WA COR, that will include the inland port area, airport, and highways. The storage and charging facility is anticipated to be made available by a local air monitoring agency partner as identified by the WA COR. The contractor shall provide trailer transportation to bring the car to and from the Memphis area, as well as from the storage/charging facility to and from each of the sampling locations. This study is anticipated to occur directly after in conjunction with the mobile monitoring field study in Oakland, California, so pre-study equipment evaluations will not be required. In addition, tThis work will be covered in the vegetative barrier QAPP for JTI-WA1-039.~~

~~Deliverable 10.1: The contractor shall provide raw and quality-reviewed data to the WA COR within 60 days of sampling completion.~~

~~Deliverable 10.2: The contractor shall provide a report summarizing the results of the measurements in the Memphis study including sampler QA, estimated motor vehicle emission factors and assessment of the data trends~~

~~Task 11. Mobile Monitoring Field Measurements: Near-Source Study in Kansas City~~

~~The contractor shall conduct a mobile monitoring study for up to four (4) weeks in Kansas City, Kansas, for CO, CO2, NO2 and PM. The several hour mobile monitoring sessions shall be conducted in the vicinity of a large railyard, although also encompass measurements near highways and industrial facilities as determined by the WA COR. The vehicle will also be collocated at fixed sites installed and operated by EPA Region 7 in the vicinity of the railyard. The storage and charging facility is anticipated to be made available by a local air monitoring agency partner as identified by the WA COR. The contractor shall provide trailer~~

~~transportation to bring the car to and from the Kansas City area, as well as from the storage/charging facility to and from each of the sampling locations. This study is part of a collaboration with EPA Region 7 and community groups that will include the fixed site measurements and portable sensors. The mobile monitoring work described in this task will be covered in the QAPP under this separate JTI WA, which will include external peer review. The contractor will review this QAPP prior to the external peer review and after the EPA response to comments for approval and consistency. This field study is anticipated to be conducted in conjunction with the Oakland and Memphis studies to reduce vehicle and equipment shipping costs to the extent feasible and not require pre-study equipment evaluations.~~

~~Deliverable 11.1: The contractor shall provide raw and quality reviewed data to the WA COR within 60 days of sampling completion.~~

~~Deliverable 11.2: The contractor shall provide a report summarizing the results of the measurements in the Kansas City study including sampler QA, estimated motor vehicle emission factors and assessment of the data trends~~

WA SPECIFIC EQUIPMENT

The contractor shall purchase (as Contractor Acquired Equipment) portable air quality sensors to measure the impacts of roadside vegetation barriers on downwind air quality. The contractor shall consult EPA experts on air quality sensors to recommend samplers for PM, BC and NO2 capable of providing measurements at ambient air concentrations to be expected near large roadways. Up to ~~five~~ eight (~~5~~8) sampling packs will be needed for this study. In addition, environmental monitoring shelters will need to be established for this project if not already provided by the manufacturer(s). These systems will utilize hand-held monitoring equipment and GPS capabilities into an integrated system capable of mapping spatial distributions of pollutant concentrations. The contractor shall also purchase equipment needed for calibration, maintenance and operation of the equipment identified in this WA including calibration gases, fittings, tubing, etc. The contractor shall obtain and operate Government Furnished Equipment as specified in this WA including air quality analyzers, the GMAP and SUV mobile monitoring vehicles, and select portable samplers.

QUALITY ASSURANCE

A QAPP has been approved for the chase vehicle and Woodside/Palo Alto, California field studies. The field sampling configurations and quality assurance requirements are described in an approved Category III QAPP which will be provided by the EPA WA COR with assistance from the contractor. The QAPP shall be applicable to the

studies in ~~both~~ Oakland ~~and Detroit~~. This QAPP shall be accompanied by a signature page that is signed by the Jacobs work assignment leader and QA officer to show that they have reviewed and approved the QAPP. It is the responsibility of the Jacobs work assignment leader to document this process. Upon receipt of the signed QAPP, the EPA work assignment manager and QA manager will review and approve the QAPP and they will add their signatures to the signature page. Work involving environmental data shall not commence until the QAPP has received official approval from the EPA Quality Assurance Staff.

DELIVERABLES WITH SCHEDULE

Deliverable 2.1: Contractor shall submit an updated GMAP vehicle safety plan for ~~the~~ all field ~~study~~ studies to the EPA WA COR prior to initiating field measurements and provide general vehicle support. If applicable, the plan developed for this option period can be used for this field study (at least 30 days prior to field study)

Deliverable 2.2: Contractor shall provide a signed agreement for technical support from the GMAP vehicle manufacturer through at least three months after the proposed completion date for this project in the contractor's project workplan, to be completed prior to initiating field measurements. This agreement shall include in-person support during domestic deployments. If applicable, the agreement developed for this option period can be used for this field study (at least 30 days prior to field study)

Deliverable 2.3: Contractor shall provide a safe, working GMAP vehicle equipped with instruments required under this work assignment, including making any repairs and improvements needed to the GMAP vehicle to fully implement the field studies (at least 30 days prior to field study)

~~Deliverable 3.1: The contractor shall provide raw time-stamped inter-comparison data to the EPA WA COR, within one week of sampling completion for the RTP study (anticipate study in December, 2016 pending GMAP repairs completed 1 month prior)~~

Formatted: Strikethrough

~~Deliverable 4.1: The contractor shall provide raw time-stamped chase study data to the EPA WA COR, within one week of sampling completion for the RTP study.~~

~~Deliverable 4.2: The contractor shall provide a report summarizing the results of the measurements in the RTP study including sampler QA, estimated motor vehicle emission factors and assessment of the chase method within 8 weeks of study completion~~

Deliverable 5.1: Contractor shall submit an updated SOP for the use of the portable air quality sensors sampling systems for use in Oakland and Detroit to the EPA WA COR prior to initiating field measurements. If applicable, the SOP developed for this option period can be used for this field study.

Deliverable 5.2: The contractor shall provide raw time-stamped and statistically analyzed (scatterplots, correlation coefficients) inter-comparison data to the EPA WA COR, within ~~two~~ four weeks of sampling completion.

Deliverable 6.1: The contractor shall provide raw time-stamped and statistically analyzed (scatterplots, correlation coefficients) inter-comparison data to the EPA WA COR, within two weeks of sampling completion. (anticipate Detroit study in Oct/Nov, 2016 pending planting completion in Oct; Oakland study in Jan/Feb pending planting in Oct/Nov/Dec)

Deliverable 6.2: The contractor shall provide a report for the Oakland, California area measurement campaigns comparing the mobile monitoring measurements with the GMAP, Google and California ARB mobile monitoring vehicles including the methods used in the study, data analysis of the measurements collected, and trends from the analysis for data collected. This could be a separate report or combined with the report for Deliverable 7.3 under Task 7

Deliverable 7.1: The contractor shall provide raw time-stamped concentration and meteorological data from the four, ~~2-week~~ studies, two in Oakland, California and one each in Woodside and Palo Alto, California~~Detroit, Michigan~~, to the EPA WA COR (e.g. upload to a shared file folder or e-mailed to the EPA WA COR) within 3 days of data collection. The data to be reported and formatting will be described in the QAPP~~. (anticipate pre-sampling studies in Oakland and Detroit in April/May, 2016; Detroit post-planting study in Oct/Nov, 2016 pending planting completion in Oct; Oakland post-planting study in Jan/Feb, 2017 pending planting in Oct/Nov/Dec)~~

Formatted: Strikethrough

Deliverable 7.2: The contractor shall provide a complete data package (DP) for the each of the four, ~~2-week~~ roadside vegetation studies, two in Oakland, California and one each in Woodside and Palo Alto, California~~Detroit, Michigan~~ within 4 weeks of field monitoring completion. The DP shall include field notes, quality-assured field data, in-field quality indicators, calibration checks (to be outlined in the QAPP), and video. No contractor-generated report will be required as a deliverable. This DP will include data collected in Tasks 6 and 7

Deliverable 7.3: The contractor shall provide a report for the Oakland, California area measurement campaigns detailing the methods used in the study, data analysis of the measurements collected, and trends from the analysis for data collected under Tasks 6 and 7 within 10 weeks of field monitoring completion for the second, post-planting field study

~~Deliverable 7.4: The contractor shall provide a report for the two Detroit, Michigan measurement campaigns detailing the methods used in the study, data analysis of the measurements collected, and trends from the analysis for data collected under Tasks 6 and 7 within 10 weeks of field monitoring completion for the second, post-planting field study~~

Formatted: Strikethrough

~~Deliverable 7.5: The contractor shall submit a summary of how the results from the Oakland and Detroit field studies could be used to design and assess the benefits of~~

~~using roadside vegetation for walking and biking paths along busy roads, including a comparison with a case study~~

Deliverable 8.1: The contractor shall provide a database of model inputs for the field studies to be evaluated based on historical data (within 60 days of project initiation)

Deliverable 8.2: The contractor shall provide model outputs for all model calculations (within 90 days of Deliverable 8.1)

Deliverable 8.3: The contractor shall provide a description and model code for the vegetation barrier algorithm (within 300 days of Deliverable 8.1)

Deliverable 8.4: The contractor shall provide a summary report of model vs. measurement results for the field studies evaluated that includes a list of field studies evaluated (including the work under this WA), model inputs used, comparison of performance metrics, and results from the sensitivity simulations (within 300 days of Deliverable 8.1)

Deliverable 9.1: The contractor shall provide for WACOR approval a modeling protocol to describe the purpose of the sensitivity analysis; how the analysis will be conducted, including how emissions inventories will be generated, and/or their source, the source of the input data in emissions inventories; how they compare to each other, the geographic area covered, the analysis year and other time information covered by the inventories, etc.; a description of how the emissions inventories differ from one another; and how air quality modeling will be conducted, including source characterization choices, meteorological data to be used, receptor placement, etc. (within 30 days of amended workplan approval)

Deliverable 9.2: The contractor shall provide databases of the generated emission inventories, along with a memo that relates the databases to the description in the modeling protocol, noting any deviations from the modeling protocol. If MOVES is used to generate these inventories, this memo shall include detail about the run specification ("RunSpec") choices and the input database choices for each inventory as well as the source of the data for the input database. (by March, 2017)

Deliverable 9.3: The contractor shall provide model input files and outputs for all model calculations, i.e., for emissions modeling with MOVES, RunSpec files, and input and output databases; for air quality modeling with AERMOD, both the input and output files. (by March, 2017)

Deliverable 9.4: The contractor shall provide for WAM approval a summary report describing the sensitivity analyses, modeling procedures, and measurement data employed, including appropriate statistical, tabular, or graphical displays of information. The summary report can build on the modeling protocol from Deliverable 8b.1, with results and conclusions added. (by March, 2017)

~~Deliverable 10.1: The contractor shall provide raw and quality-reviewed data to the WA COR within 60 days of sampling completion. (anticipate study in Jan/Feb/Mar, 2017 pending Oakland post-planting study occurs in Jan/Feb, 2017)~~

~~Deliverable 10.2: The contractor shall provide a report summarizing the results of the measurements in the Memphis study including sampler QA, estimated motor vehicle emission factors and assessment of the data trends~~

~~Deliverable 11.1: The contractor shall provide raw and quality-reviewed data to the WA COR within 60 days of sampling completion. (anticipat study in Jan/Feb/Mar, 2017 pending Oakland post-planting study occurs in Jan/Feb, 2017, EPA approves the project QAPP, and EPA Region 7 installs fixed-site monitors prior to this date)~~

~~Deliverable 11.2: The contractor shall provide a report summarizing the results of the measurements in the Kansas City study including sampler QA, estimated motor vehicle emission factors and assessment of the data trends~~

Formatted: Strikethrough

ATTACHMENT #1 TO THE STATEMENT OF WORK (SOW)

FOR MEASUREMENT PROJECTS

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD (mark all that apply):

- ☐ **NRMRL's Quality System Specifications:**

  (1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

  (2) an organizational chart showing the position of the QA function;

  (3) delineation of the authority and responsibilities of the QA function;

  (4) the background and experience of the QA personnel who will be assigned to the project; and

  (5) the organization's general approach for accomplishing the QA specifications in the SOW.

- ☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,

  http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

- ☐ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function; 07/14/08 A-2

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,

http://www.epa.gov/quality/qs-docs/r2-final.pdf

☐ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X **QAPP Requirements for Measurement Projects**

☐ **QAPP Requirements for Secondary Data Projects**

☐ **QAPP Requirements for Research Model Development and/or Application Projects**

☐ **QAPP Requirements for Software Development Projects**

☐ **QAPP Requirements for Method Development Projects**

☐ **QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/

EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

---

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS:

Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.

1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.

2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.

3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.

3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.

4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.

4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.

4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.

4.5 Describe the method for uniquely numbering each sample.

4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5 MEASUREMENT PROCEDURES

5.1 Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.

5.2 If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6 QUALITY METRICS (QA/QC CHECKS)

6.1 For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

6.2 Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7 DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

7.2 Describe data validation procedures used to ensure the reporting of accurate project data.

7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).

7.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

7.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

7.4 Describe data storage requirements for both hard copy and electronic data.

8 REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA	United States Environmental Protection Agency Washington, DC 20460 **Work Assignment**	Work Assignment Number 1-027 ☐ Other ☐ Amendment Number:

Contract Number	Contract Period 04/01/2015 To 03/31/2017 Base X Option Period Number	Title of Work Assignment/SF Site Name
EP-C-15-008		1-027 APPCD Met Lab QA

Contractor	Specify Section and paragraph of Contract SOW
JACOBS TECHNOLOGY INC.	4, 6

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance
From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — **Accounting and Appropriations Data** — [X] Non-Superfund

SFO (*Max 2*) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Scott Moore (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-5104 FAX Number:
Project Officer Name Robin Baily (Signature) (Date)		Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:
Other Agency Official Name (Signature) (Date)		Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Mark Cranley (Signature) (Date)		Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

Performance Work Statement

WA Title: APPCD Metrology QA Laboratory Support

WA Short Title: APPCD Met Lab SUPT

WA #: 1-027 **WACOR:** Scott A. Moore

Contract #: EP-C-15-008 **ALT. WACOR:** Paul W. Groff

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from April 1, 2016 through March 31, 2017.

INTRODUCTION

Good Quality Assurance (QA) practice requires that routine operations in a research facility be conducted according to prescribed procedures and that data be of known and adequate quality. To ensure good QA, it is necessary that instrumentation be maintained in good working condition and that it be checked regularly to ensure that it produces reliable data. The Environmental Protection Agency (EPA) requires that QA practices be established and applied to all research measurement efforts. The Metrology Laboratory (Met Lab) provides QA assistance to EPA researchers by providing the procedures and the standards to calibrate various scientific devices.

SUMMARY OF OBJECTIVES

The objective of this Work Assignment (WA) is to provide Met Lab support to EPA researchers. The Met Lab is a facility with the capabilities to check (or audit) the calibration of EPA measurement instrumentation. A second objective is to provide support for preparing and verifying Performance Evaluation Audit (PEA) samples. The overall goal is to ensure and document that operations performed in EPA facilities produce data that will be of scientifically and legally defendable quality. This WA does not pertain to the calibration of facility devices such as smoke detectors, lights, or any health and safety related devices such as ambient Carbon Monoxide (CO) monitors that alarm strictly for safety reasons.

BACKGROUND

Data Uses:
Primary users of the products of this WA will be researchers and operators of equipment in the EPA facilities. The following divisions are currently using the Met Lab services:
The Air Pollution Prevention and Control Division (APPCD)

The National Health and Environmental Effects Research Laboratory (NHEERL)
The Office of Air Quality Planning and Standards (OAQPS)
The Decontamination and Consequence Management Division (DCMD)
The National Exposure Research Laboratory (NERL)

Calibration and PEA results can be reported in research reports to support or verify findings. All Quality Assurance Project Plans (QAPP) will be the responsibility of the project lead or principle investigator of the equipment being calibrated.

Lab Site: The Met Lab is located in rooms D360-A, D362 and D364-A in EPA's Research Center in Research Triangle Park, NC.

Experience: Personnel assigned to this WA must be capable of performing the tasks listed in each of the assigned Tasks, which include electrical work, plumbing, general experience with lab equipment and materials, a familiarity with the calibration of measurement devices and a fundamental understanding of the principals behind the measurements. Lab personnel will also require the ability to reduce data and report it according to the International Organization for Standardization (ISO) "General Requirements for the Competence of Calibration and Testing Laboratories" (ISO 17025) standard and the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM).

SCOPE

(1) The Met Lab was developed as a central means of providing the best practice for the calibration of laboratory equipment and at a low price by sharing those costs between various labs. The Contractor shall use their best practice in sharing the costs of equipment calibrations, repairs, system upgrades, purchases and labor hours evenly (based on volume of work) between all the WA issued pertaining to Metrology Support.

(2) The Contractor shall obtain performance specifications on potential calibration equipment. The Contractor shall maintain and upgrade calibration systems and equipment as needed. Final decisions regarding upgrading and replacing equipment will be relayed to the Contractor in a technical directive through the WA Contracting Officer Representative (WACOR).

(3) The Contractor shall maintain Met Lab equipment in proper working order. The Contractor shall identify calibration needs and ensure that the necessary factory equipment calibrations for the Met Lab equipment are kept up to date. The Contractor shall maintain a record of all maintenance activities. Whenever practically possible, the calibration data for this equipment shall include National Institute of Standards and Technology (NIST) traceable information.

(4) The Contractor shall perform monthly Quality Assurance and/or Quality Control QA/QC checks of the X-ray Fluorescence (XRF) in Room E360. The Contractor shall assist Principle Investigators (PI) with scheduling XRF usage, sample preparation and

analysis of collected samples. The Contractor will inform the WACOR of any scheduling conflicts and of any non-routine maintenance issues.

(5) The Contractor shall report the total number of hours and the total expenses incurred for all objectives, with each monthly invoice, in this Performance Work Statement (PWS).

(6) The Contractor shall perform measurement device and equipment calibrations that conform to ISO 17025 and the GUM. The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be delivered on time because multiple projects have overloaded the ability of the laboratory, the WACOR will assign project priority.

(7) The Contractor shall begin the process of acquiring ISO 17025 Accreditation for the Met Lab. Details of the ISO 17025 Accreditation will be detailed in WA 1-041.

(8) The Contractor shall provide Technical Support for any Principle Investigator (PI) that may need assistance with projects that will need Met Lab support.

(9) The Contractor shall develop, document, and implement detailed calibration operating procedures for all laboratory calibration services.

(10) The Contractor shall assemble and maintain a system of published procedures and product information relevant to calibration measurement procedures and measurement devices.

(11) The Contractor shall confirm the current acceptable validation methods for all calibration systems used in the Met Lab and also for the calibration tracking system. Any confirmation of validation methods shall be documented. All database functions that are user-programmed shall be tested and the validation documented. Each revision to the database software (exclusive of the data in the database) shall have an identifiable revision number assigned to it.

TECHNICAL APPROACH/OBJECTIVES

OBJECTIVE 1: Recertification of APPCD Analytical Balances

The Contractor shall recertify all analytical balances that are in active use and that have not been recertified within the past year. These balances have been identified in a spreadsheet that has been prepared by APPCD's QA team and this spreadsheet will be made available to the Contractor. The Contractor shall contact the individual who has been identified as each balance's custodian to arrange for a date to recertify the balance. After each balance recertification, the Contractor shall update the spreadsheet and the

Contractor shall maintain that spreadsheet in a location easily accessible to all APPCD staff.

OBJECTIVE 2: Monitoring of Temperatures of APPCD Refrigerators and Freezers

APPCD has purchased HOBO® temperature data loggers to monitor the temperatures of APPCD refrigerators and freezers. The Contractor shall verify the calibration of the data loggers on a annual basis. After the verification, the Contractor shall deploy the data loggers in APPCD refrigerators and freezers. Thrice-yearly the Contractor shall download temperature data from the data loggers, replace batteries if necessary and post the downloaded data in a location easily accessible to all APPCD staff.

OBJECTIVE 3: Weights, Flows, Temperature, Pressure, Voltage and Relative Humidity (RH) Calibration Support

The Contractor shall calibrate/verify Weight sets, Flow devices, Temperature devices, Pressure devices, Voltage devices and RH Meters for APPCD Labs. The total number of APPCD devices is difficult to calculate due to instruments that are purchased, excessed or moved based on project activity. The Contractor shall use their best practice to accommodate as many of the calibrations as possible and inform the WACOR of any difficulties that may arise.

OBJECTIVE 4:- Duke Forest Site Support

Duke Forest is a remote location near Chapel Hill, NC where EPA is continuing research. The Contractor shall provide support for this location by providing calibrations and/or repairs to the sampling equipment, this includes equipment in Lab E584 that will be deployed at Duke Forest Site and Duke Forest site modifications. Specific details shall be detailed in Technical Directives from the WACOR.

WA SPECIFIC EQUIPMENT

Any equipment used in the Met Lab is shared among different work assignments and no equipment is specific to this work assignment.

QUALITY ASSURANCE

Quality Assurance for any individual instrument would fall under the QAPP for the program that the instrument is being used by.

DELIVERABLES

The Contractor shall provide the following reports for APPCD:

(1) Monthly reports of the laboratory support activities including the following:

a) The number of and type of calibrations performed.
b) Any costs incurred during calibration activities.
c) Any maintenance activities performed.
d) Any documentation activities performed.
e) Status of the Facility Manuals.
f) Any other activities that would impact the operation of the Met Lab.

(2) Special reports as requested via a Technical Directive by the WACOR.

(3) The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be delivered on time because multiple projects have overloaded the ability of the laboratory, the WACOR shall be notified and then provide technical direction to the Contractor for prioritization.

(4) The WACOR shall be copied on all correspondence to and from any laboratories and venders used in the completion of the tasks associated with the projects. Any documents or literature during any of these correspondences will also be made available to the WACOR.

(5) The Contractor shall provide a Calibration Certificate for each device and give it to the Principle Investigator (PI) or to the Contractor Task Lead and keep a copy (either hard copy or electronic) on record.

(6) Formatting of reports shall be consistent with historical reporting and electronic files shall be compatible with Agency Standard Software. During EPA Fiscal Year 2015 (FY15) federal employees and Contractors will be using Windows 7 Enterprise, Adobe Reader 10 and Microsoft Office 2013. Any upgrades will be announce by OEI. Hard copies of reports are acceptable; however, electronic copies are encouraged.

SHEDULE OF DELIVERABLES

Each calibration report will be considered a deliverable. The Contractor shall provide all deliverables within 14 days after completing a calibration. Monthly reports shall be due at the same time the contractor invoiced EPA.

EPA	United States Environmental Protection Agency Washington, DC 20460 **Work Assignment**	Work Assignment Number 1-028 ☐ Other ☐ Amendment Number:

Contract Number	Contract Period 04/01/2015 To 03/31/2017	Title of Work Assignment/SF Site Name
EP-C-15-008	Base X Option Period Number	1-028

Contractor	Specify Section and paragraph of Contract SOW
JACOBS TECHNOLOGY INC.	1, 6

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance
From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Scott Moore	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-5104 FAX Number:
Project Officer Name Robin Baily	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:
Other Agency Official Name	(Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Mark Cranley	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

Performance Work Statement

WA Title: NHEERL Metrology QA Laboratory Support

WA Short Title: NHEERL Met Lab SUPT

WA #: 1-028 **WACOR:** Scott A. Moore

Contract #: EP-C-15-008 **ALT. WACOR:** Paul W. Groff

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from April 1, 2016 through March 31, 2017.

INTRODUCTION

Good Quality Assurance (QA) practice requires that routine operations in a research facility be conducted according to prescribed procedures and that data be of known and adequate quality. To ensure good QA it is necessary that instrumentation be maintained in good working condition and that it be checked regularly to ensure that it produces reliable data. The Environmental Protection Agency (EPA) requires that QA practices be established and applied to all research measurement efforts. The Metrology Laboratory (Met Lab) provides QA assistance to EPA researchers by providing the procedures and the standards to calibrate various scientific devices.

SUMMARY OF OBJECTIVES

The objective of this Work Assignment (WA) is to provide Met Lab support to EPA researchers. The Met Lab is a facility with the capabilities to check (or audit) the calibration of EPA measurement instrumentation. A second objective is to provide support for preparing and verifying Performance Evaluation Audit (PEA) samples. The overall goal is to ensure and document that operations performed in EPA facilities produce data that will be of scientifically and legally defendable quality. This WA does not pertain to the calibration of facility devices such as smoke detectors, lights, or any health and safety related devices such as ambient Carbon Monoxide (CO) monitors that alarm strictly for safety reasons.

BACKGROUND

Data Uses:
Primary users of the products of this WA will be researchers and operators of equipment in the EPA facilities. The following divisions are currently using the Met Lab services:
The Air Pollution Prevention and Control Division (APPCD)

The National Health and Environmental Effects Research Laboratory (NHEERL)
The Office of Air Quality Planning and Standards (OAQPS)
The Decontamination and Consequence Management Division (DCMD)
The National Exposure Research Laboratory (NERL)

Calibration and PEA results can be reported in research reports to support or verify findings. All Quality Assurance Project Plans (QAPP) will be the responsibility of the project lead or principle investigator of the equipment being calibrated.

Lab Site: The Met Lab is located in rooms D360-A, D362 and D364-A in EPA's Research Center in Research Triangle Park, NC.

Experience: Personnel assigned to this WA must be capable of performing the tasks listed in each of the assigned Tasks, which include electrical work, plumbing, general experience with lab equipment and materials, a familiarity with the calibration of measurement devices and a fundamental understanding of the principals behind the measurements. Lab personnel will also require the ability to reduce data and report it according to the International Organization for Standardization (ISO) "General Requirements for the Competence of Calibration and Testing Laboratories" (ISO 17025) standard and the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM).

SCOPE

(1) The Met Lab was developed as a central means of providing the best practice for the calibration of laboratory equipment and at a low price by sharing those costs between various labs. The Contractor shall use their best practice in sharing the costs of equipment calibrations, repairs, system upgrades, purchases and labor hours evenly (based on volume of work) between all the WA issued pertaining to Metrology Support.

(2) The Contractor shall obtain performance specifications on potential calibration equipment. The Contractor shall maintain and upgrade calibration systems and equipment as needed. Final decisions regarding upgrading and replacing equipment will be relayed to the Contractor in a technical directive through the WA Contracting Officer Representative (WACOR).

(3) The Contractor shall maintain Met Lab equipment in proper working order. The Contractor shall identify calibration needs and ensure that the necessary factory equipment calibrations for the Met Lab equipment are kept up to date. The Contractor shall maintain a record of all maintenance activities. Whenever practically possible, the calibration data for this equipment shall include National Institute of Standards and Technology (NIST) traceable information.

(4) The Contractor shall perform monthly Quality Assurance and/or Quality Control QA/QC checks of the X-ray Fluorescence (XRF) in Room E360. The Contractor shall assist Principle Investigators (PI) with scheduling XRF usage, sample preparation and

analysis of collected samples. The Contractor will inform the WACOR of any scheduling conflicts and of any non-routine maintenance issues.

(5) The Contractor shall perform measurement device and equipment calibrations that conform to ISO 17025 and the GUM. The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be delivered on time because multiple projects have overloaded the ability of the laboratory, the WACOR will assign project priority.

(6) The Contractor shall begin the process of acquiring ISO 17025 Accreditation for the Met Lab. Details of the ISO 17025 Accreditation will be detailed in WA 1-041.

(7) The Contractor shall provide Technical Support for any Principle Investigator (PI) that may need assistance with projects that will need Met Lab support.

(8) The Contractor shall develop, document, and implement detailed calibration operating procedures for all laboratory calibration services.

(9) The Contractor shall assemble and maintain a system of published procedures and product information relevant to calibration measurement procedures and measurement devices.

(10) The Contractor shall confirm the current acceptable validation methods for all calibration systems used in the Met Lab and also for the calibration tracking system. Any confirmation of validation methods shall be documented. All database functions that are user-programmed shall be tested and the validation documented. Each revision to the database software (exclusive of the data in the database) shall have an identifiable revision number assigned to it.

TECHNICAL APPROACH/OBJECTIVES

OBJECTIVE 1: NHEERL Calibration of Analytical

The Contractor shall perform measurement device and equipment calibrations that conform to the NHEERL Calibration SOPs or ISO 17025 and the GUM. Some of these devices will be carried to the Met Lab for calibration. Other devices cannot be physically carried to the Met Lab facility, therefore the Contractor will need to take portable calibration equipment to the NHEERL Lab to perform the calibration. The Contractor shall maintain a record and data base of all equipment calibrations and calibration schedules. The following devices from NHEERL will be calibrated by the Met Lab:

354	balances
24	plate readers
74	pH meters

2	luminometers
26	spectrometers
7	Thermometers
30	mass sets
2000	pipettes

<u>OBJECTIVE 2:</u> NHEERL Additional Calibration and Repairs

The Contractor shall calibrate other devices not on this list as labor hours will allow. There may be circumstances where the calibration (or repair) of an instrument is beyond the technical expertise of the Met Lab. If this occurs, the Contractor shall make the arrangements with the instrument vender to have the instrument repaired and /or recalibrated. The Contractor shall communicate with the WACOR the status of that instrument throughout that process.

WA SPECIFIC EQUIPMENT

Any equipment used in the Met Lab is shared among different work assignments and no equipment is specific to this work assignment.

QUALITY ASSURANCE

Quality Assurance for any individual instrument would fall under the QAPP for the program that the instrument is being used by.

DELIVERABLES

The Contractor shall provide the following reports for APPCD:

(1) Monthly reports of the laboratory support activities including the following:

a) The number of and type of calibrations performed.
b) Any costs incurred during calibration activities.
c) Any maintenance activities performed.
d) Any documentation activities performed.
e) Status of the Facility Manuals.
f) Any other activities that would impact the operation of the Met Lab.

(2) Special reports as requested via a Technical Directive by the WACOR.

(3) The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be delivered on time because multiple projects have overloaded the ability of the laboratory, the WACOR shall be notified and then provide technical direction to the Contractor for prioritization.

(4) The WACOR shall be copied on all correspondence to and from any laboratories and venders used in the completion of the tasks associated with the projects. Any documents or literature during any of these correspondences will also be made available to the WACOR.

(5) The Contractor shall provide a Calibration Certificate for each device and give it to the Principle Investigator (PI) or to the Contractor Task Lead and keep a copy (either hard copy or electronic) on record.

(6) Formatting of reports shall be consistent with historical reporting and electronic files shall be compatible with Agency Standard Software. During EPA Fiscal Year 2015 (FY15) federal employees and Contractors will be using Windows 7 Enterprise, Adobe Reader 10 and Microsoft Office 2013. Any upgrades will be announce by OEI. Hard copies of reports are acceptable; however, electronic copies are encouraged.

SHEDULE OF DELIVERABLES

All calibration reports would be considered a deliverables. The Contractor shall provide all deliverables within 14 days after completing a calibration. Monthly reports shall be due at the same time the contractor invoiced EPA.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-029

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base X Option Period Number	1-029

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 1, 6

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — **Accounting and Appropriations Data** — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Scott Moore	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-5104 FAX Number:
Project Officer Name Robin Baily	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Mark Cranley	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

Performance Work Statement

WA Title: DCMD Metrology QA Laboratory Support

WA Title: DCMD Met Lab SUPT

WA #: 1-029 **WACOR:** Scott A. Moore

Contract #: EP-C-15-008 **ALT. WACOR:** Paul W. Groff

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from April 1, 2016 through March 31, 2017.

INTRODUCTION

Good Quality Assurance (QA) practice requires that routine operations in a research facility be conducted according to prescribed procedures and that data be of known and adequate quality. To ensure good QA, it is necessary that instrumentation be maintained in good working condition and that it be checked regularly to ensure that it produces reliable data. The Environmental Protection Agency (EPA) requires that QA practices be established and applied to all research measurement efforts. The Metrology Laboratory (Met Lab) provides QA assistance to EPA researchers by providing the procedures and the standards to calibrate various scientific devices.

SUMMARY OF OBJECTIVES

The objective of this Work Assignment (WA) is to provide Met Lab support to EPA researchers. The Met Lab is a facility with the capabilities to check (or audit) the calibration of EPA measurement instrumentation. A second objective is to provide support for preparing and verifying Performance Evaluation Audit (PEA) samples. The overall goal is to ensure and document that operations performed in EPA facilities produce data that will be of scientifically and legally defendable quality. This WA does not pertain to the calibration of facility devices such as smoke detectors, lights, or any health and safety related devices such as ambient Carbon Monoxide (CO) monitors that alarm strictly for safety reasons.

BACKGROUND

Data Uses:
Primary users of the products of this WA will be researchers and operators of equipment in the EPA facilities. The following divisions are currently using the Met Lab services:
The Air Pollution Prevention and Control Division (APPCD)

The National Health and Environmental Effects Research Laboratory (NHEERL)
The Office of Air Quality Planning and Standards (OAQPS)
The Decontamination and Consequence Management Division (DCMD)
The National Exposure Research Laboratory (NERL)

Calibration and PEA results can be reported in research reports to support or verify findings. All Quality Assurance Project Plans (QAPP) will be the responsibility of the project lead or principle investigator of the equipment being calibrated.

Lab Site: The Met Lab is located in rooms D360-A, D362 and D364-A in EPA's Research Center in Research Triangle Park, NC.

Experience: Personnel assigned to this WA must be capable of performing the tasks listed in each of the assigned Tasks, which include electrical work, plumbing, general experience with lab equipment and materials, a familiarity with the calibration of measurement devices and a fundamental understanding of the principals behind the measurements. Lab personnel will also require the ability to reduce data and report it according to the International Organization for Standardization (ISO) "General Requirements for the Competence of Calibration and Testing Laboratories" (ISO 17025) standard and the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM).

SCOPE

(1) The Met Lab was developed as a central means of providing the best practice for the calibration of laboratory equipment and at a low price by sharing those costs between various labs. The Contractor shall use their best practice in sharing the costs of equipment calibrations, repairs, system upgrades, purchases and labor hours evenly (based on volume of work) between all the WA issued pertaining to Metrology Support.

(2) The Contractor shall obtain performance specifications on potential calibration equipment. The Contractor shall maintain and upgrade calibration systems and equipment as needed. Final decisions regarding upgrading and replacing equipment will be relayed to the Contractor in a technical directive through the WA Contracting Officer Representative (WACOR).

(3) The Contractor shall maintain Met Lab equipment in proper working order. The Contractor shall identify calibration needs and ensure that the necessary factory equipment calibrations for the Met Lab equipment are kept up to date. The Contractor shall maintain a record of all maintenance activities. Whenever practically possible, the calibration data for this equipment shall include National Institute of Standards and Technology (NIST) traceable information.

(4) The Contractor shall perform monthly Quality Assurance and/or Quality Control QA/QC checks of the X-ray Fluorescence (XRF) in Room E360. The Contractor shall

assist Principle Investigators (PI) with scheduling XRF usage, sample preparation and analysis of collected samples. The Contractor will inform the WACOR of any scheduling conflicts and of any non-routine maintenance issues.

(5) The Contractor shall perform measurement device and equipment calibrations that conform to ISO 17025 and the GUM. The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be delivered on time because multiple projects have overloaded the ability of the laboratory, the WACOR will assign project priority.

(6) The Contractor shall begin the process of acquiring ISO 17025 Accreditation for the Met Lab. Details of the ISO 17025 Accreditation will be detailed in WA 1-041.

(7) The Contractor shall provide Technical Support for any Principle Investigator (PI) that may need assistance with projects that will need Met Lab support.

(8) The Contractor shall develop, document, and implement detailed calibration operating procedures for all laboratory calibration services.

(9) The Contractor shall assemble and maintain a system of published procedures and product information relevant to calibration measurement procedures and measurement devices.

(10) The Contractor shall confirm the current acceptable validation methods for all calibration systems used in the Met Lab and also for the calibration tracking system. Any confirmation of validation methods shall be documented. All database functions that are user-programmed shall be tested and the validation documented. Each revision to the database software (exclusive of the data in the database) shall have an identifiable revision number assigned to it.

TECHNICAL APPROACH/OBJECTIVES

OBJECTIVE 1: Recertification of DCMD Analytical Balances

The Contractor shall recertify all analytical balances that are in active use and that have not been recertified within the past year. The Contractor shall contact the individual who has been identified as each balance's custodian to arrange for a date to recertify the balance. After each balance recertification, the Contractor shall update the Met lab database. Contractor shall perform a verification of any of DCMD's weight sets upon request or as needed.

OBJECTIVE 2: Monitoring of Temperatures of DCMD Refrigerators and Freezers

DCMD has purchased HOBO® temperature data loggers to monitor the temperatures of DCMD refrigerators and freezers. The Contractor shall verify the calibration of the data loggers on an annual basis. After the verification, the Contractor shall deploy the data

loggers in DCMD refrigerators and freezers. Thrice-yearly the Contractor shall download temperature data from the data loggers, replace batteries if necessary and post the downloaded data in a location easily accessible to all DCMD staff.

OBJECTIVE 3: Weights, Flows, Temperature, Pressure, Voltage and Relative Humidity (RH) Calibration Support

The Contractor shall calibrate/verify Weight sets, Flow devices, Temperature devices, Pressure devices, Voltage devices and RH Meters for DCMD Labs. The total number of DCMD devices is difficult to calculate due to instruments that are purchased, excessed or moved based on project activity. The Contractor shall use their best practice to accommodate as many of the calibrations as possible and inform the WACOR of any difficulties that may arise.

OBJECTIVE 4: DCMD Additional Calibration and Repairs

The Contractor shall calibrate other devices not on this list as labor hours will allow. There may be circumstances where the calibration (or repair) of an instrument is beyond the technical expertise of the Met Lab. If this occurs, the Contractor shall make the arrangements with the instrument vender to have the instrument repaired and /or recalibrated. The Contractor shall communicate with the WACOR the status of that instrument throughout that process.

WA SPECIFIC EQUIPMENT

Any equipment used in the Met Lab is shared among different work assignments and no equipment is specific to this work assignment.

QUALITY ASSURANCE

Quality Assurance for any individual instrument would fall under the QAPP for the program that the instrument is being used by.

DELIVERABLES

The Contractor shall provide the following reports for DCMD:

(1) Monthly reports of the laboratory support activities including the following:

a) The number of and type of calibrations performed.
b) Any costs incurred during calibration activities.
c) Any maintenance activities performed.
d) Any documentation activities performed.
e) Status of the Facility Manuals.
f) Any other activities that would impact the operation of the Met Lab.

(2) Special reports as requested via a Technical Directive by the WACOR.

(3) The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be delivered on time because multiple projects have overloaded the ability of the laboratory, the WACOR shall be notified and then provide technical direction to the Contractor for prioritization.

(4) The WACOR shall be copied on all correspondence to and from any laboratories and venders used in the completion of the tasks associated with the projects. Any documents or literature during any of these correspondences will also be made available to the WACOR.

(5) The Contractor shall provide a Calibration Certificate for each device and give it to the Principle Investigator (PI) or to the Contractor Task Lead and keep a copy (either hard copy or electronic) on record.

(6) Formatting of reports shall be consistent with historical reporting and electronic files shall be compatible with Agency Standard Software. During EPA Fiscal Year 2015 (FY15) federal employees and Contractors will be using Windows 7 Enterprise, Adobe Reader 10 and Microsoft Office 2013. Any upgrades will be announce by OEI. Hard copies of reports are acceptable; however, electronic copies are encouraged.

SHEDULE OF DELIVERABLES

All calibration reports would be considered a deliverables. The Contractor shall provide all deliverables within 14 days after completing a calibration. Monthly reports shall be due at the same time the contractor invoiced EPA.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-030

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name: 1-030

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 1, 6

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2015 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Scott Moore
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-5104
FAX Number:

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Work Statement

WA Title: OAQPS Metrology QA Laboratory Support

WA Short Title: OAQPS Met Lab SUPT

WA #: 1-030 **WACOR:** Scott A. Moore

Contract #: EP-C-15-008 **ALT. WACOR:** Paul W. Groff

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from April 1, 2016 through March 31, 2017.

INTRODUCTION

Good Quality Assurance (QA) practice requires that routine operations in a research facility be conducted according to prescribed procedures and that data be of known and adequate quality. To ensure good QA, it is necessary that instrumentation be maintained in good working condition and that it be checked regularly to ensure that it produces reliable data. The Environmental Protection Agency (EPA) requires that QA practices be established and applied to all research measurement efforts. The Metrology Laboratory (Met Lab) provides QA assistance to EPA researchers by providing the procedures and the standards to calibrate various scientific devices.

SUMMARY OF OBJECTIVES

The objective of this Work Assignment (WA) is to provide Met Lab support to EPA researchers. The Met Lab is a facility with the capabilities to check (or audit) the calibration of EPA measurement instrumentation. A second objective is to provide support for preparing and verifying Performance Evaluation Audit (PEA) samples. The overall goal is to ensure and document that operations performed in EPA facilities produce data that will be of scientifically and legally defendable quality. This WA does not pertain to the calibration of facility devices such as smoke detectors, lights, or any health and safety related devices such as ambient Carbon Monoxide (CO) monitors that alarm strictly for safety reasons.

BACKGROUND

This work assignment will cover one area of support for the Particulate Matter 2.5 microns and below ($PM_{2.5}$),Particulate Matter from 10 microns down to 2.5 microns ($PM_{10-2.5}$) and Lead (Pb) Performance Evaluation Programs (PEPs). The set of tasks will be to coordinate the annual certification of NIST traceability of calibration and reference standards used by EPA or its contractors and Federal Land Managers in cooperative monitoring and quality assurance programs. This work must be repeated annually because accuracy and reliability are paramount. The programs in which the reference standards are deployed to calibrate or audit performance parameters are required by 40 Code of Federal Regulations (CFR) Part 58 Appendix A.

EPA implements the Performance Evaluation Programs (PEPs) to assess bias of measurements made by the national $PM_{2.5}$ FRM/FEM monitoring network; the Lead (Pb) monitoring network, and in 2012 the PM_{coarse} network (fraction of PM-10 that is larger than $PM_{2.5}$). It is implemented through EPA Regional ESAT contractors and some State, local and Tribal audit staff. The national objective is accomplished by simultaneously measuring the same ambient pollutant concentration as a network sampler with a well maintained and closely controlled FRM sampler. EPA employs a fleet of these samplers. The fleet of samplers should operate as near identically as possible. NIST Traceable multi-calibrators (and some single-parameter devices) are used to ensure the temperature and barometric pressure sensors used by the samplers generate consistent and reproducible results. Sampler flow rates are controlled to within 4% based on the required accuracy of the calibrators.

Also EPA Regional Staff, State auditors, and Federal Land Managers perform periodic site and sampler performance audits at sites indicated above as well as the IMPROVE Network. The Calibrators/audit reference standards are similar and sometime the exact instruments used for the PEP program.

The following work assignment will provide the annual certification of the multi calibrators/audit reference standards by a NIST accredited Metrology laboratory serviced by AMEC, on the EPA Campus at RTP, NC.

The tasks will include (a) maintaining the inventory of calibrators/audit reference standards that are used in the programs under EPA oversight; (b) logistical assistance in collecting the calibrators/audit standards from the Regional, State and FLM partners; (c) performing the NIST traceability procedures; (d) allowing OAQPS to post verify the calibrators prior to returning the instruments to their location of deployment; [1] (e) returning instruments to their locations of deployment; (f) and issuing instrument advisories and a final report.

The project will certify a total of approximately 90 instruments. The instruments are typically collected in approximately 4 to 5 groups of like kind. The WAM will provide an inventory from which a natural grouping regimen will emerge. The processing of a group is called a "Round." For example, each Region will ship one of their 2 or 3 BGI Delta Cals in round 1and the other(s) in round 2. Each group is batch-processed by the metrology lab, which minimizes set-up costs and expedites the return to service.

Any instruments that do not operate within acceptance limits are identified. Certain instruments may not perform adequately at all of their design ranges; however, they may operate satisfactorily in the range or ranges that are necessary for the program in which they are deployed. Advisories of these instruments shall be issued to the EPA Regional Staff and support contractors that are responsible for their field use. An example of a previous year's report, both written and on a CD, will be provided to illustrate the desirable format and provide a starting data set. The final annual report contains the inventory, an updated Summary Report and a comprehensive report of results.

Resource Material: OAQPS will supply contact and shipping addresses for EPA Regional ESAT contacts, participating State local or Tribal partners, and any incidental contact information as the need arises.

---

[1] Occasionally an instrument has exhibited a broken wire in this test. It has to be shipping to Mesa Labs for repair before returning to service.

SCOPE

(1) The Met Lab was developed as a central means of providing the best practice for the calibration of laboratory equipment and at a low price by sharing those costs between various labs. The Contractor shall use their best practice in sharing the costs of equipment calibrations, repairs, system upgrades, purchases and labor hours evenly (based on volume of work) between all the WAs issued pertaining to Metrology Support.

(2) The Contractor shall obtain performance specifications on potential calibration equipment. The Contractor shall maintain and upgrade calibration systems and equipment as needed. Final decisions regarding upgrading and replacing equipment will be relayed to the Contractor in a technical directive through the WA Contracting Officer Representative (WACOR).

(3) The Contractor shall maintain Met Lab equipment in proper working order. The Contractor shall identify calibration needs and ensure that the necessary factory equipment calibrations for the Met Lab equipment are kept up to date. The Contractor shall maintain a record of all maintenance activities. Whenever practically possible, the calibration data for this equipment shall include National Institute of Standards and Technology (NIST) traceable information.

(4) The Contractor shall perform measurement device and equipment calibrations that conform to ISO 17025 and the GUM. The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be delivered on time because multiple projects have overloaded the ability of the laboratory, the WACOR will assign project priority.

(5) The Contractor shall begin the process of acquiring ISO 17025 Accreditation for the Met Lab. Details of the ISO 17025 Accreditation will be detailed in WA 1-041.

(6) The Contractor shall provide Technical Support for any Principle Investigator (PI) that may need assistance with projects that will need Met Lab support.

(7) The Contractor shall develop, document, and implement detailed calibration operating procedures for all laboratory calibration services.

(8) The Contractor shall assemble and maintain a system of published procedures and product information relevant to calibration measurement procedures and measurement devices.

(9) The Contractor shall confirm the current acceptable validation methods for all calibration systems used in the Met Lab and also for the calibration tracking system. Any confirmation of validation methods shall be documented. All database functions that are user-programmed shall be tested and the validation documented. Each revision to the database software (exclusive of the data in the database) shall have an identifiable revision number assigned to it.

TECHNICAL APPROACH/OBJECTIVES

OBJECTIVE 1: Details of the objective associated with this WA are stated below:

The contractor shall manage the National Institute of Science and Technology (NIST)-traceability certification of calibrators and audit reference standards for Regional PEP and speciation auditors that support the PEP and speciation programs. Instruments shall include:

- VWR** digital temperature meters and probes
- Dwyer** Handheld pressure verification device
- Andersen** Instruments dry gas meters
- R&P Chinook** flow transfer standard devices
- BGI Delta-Cal temperature, pressure, and flow calibration device
- BGI Tri-Cal or Tetra Cal temperature, pressure, and flow calibration device
- BGI HiVolCals (for high volume samplers)

** Most of these devices have been phased out of use by PEP field scientists by direction of the OAQPS QA lead for PEP and speciation, although some may be reinstituted for Pb PEP sampler internal audit devices

The NIST certifications confirm the manufacturer's claim for accuracy and readability and must be accomplished on an annual basis. Initial vendor certifications are on record at EPA. Copies of the previous annual certification will be provided and a copy should arrive with each instrument shipped by the personnel, who uses it.

OBJECTIVE 2: Calibrator Inventory Maintenance

The Contractor shall add to the "Instruments to Inventory" section of the certification notebook for the following:

A. Any additional verification equipment that is purchased by EPA OAQPS and is deployed to a specific Region's PEP implementing contractor or SLT agency
B. Any verification equipment the EPA Regional PEP and QA staff identifies as additional audit equipment for use in the PEP or for auditing PM2.5 chemical speciation, IMPROVE networks.
C. Approximately 90 instruments are deployed through the 10 Regional PEPs and OAQPS . The inventory should include approximately 22 new high volume flow or multi parameter calibration standards that have been added over the last 2 years for the implementation of the Pb PEP. The inventory should be reviewed to assure that they have been accounted for. It is likely that a few calibrators are expected may be replaced over time.

The contractor shall also document if, when and why a calibrator or audit reference standard is removed from service.

OBJECTIVE 3: Coordinate the certification process

The Contractor shall:

A. Organize the collection of similar calibration/audit standards in up to 4 groups or rounds. The ESAT contractor or the PEP lead in each Regional Office, or the staff persons in participating SLT agencies will ship the calibrators to the Contractor's RTP address.
B. When the EPA ORD's Metrology Lab contractor receives the calibrators they shall confirm each one's data on the inventory and make a preliminary assessment of its serviceability. (Sometimes upon arrival one or another characteristic is inoperable.) If a repair is necessary to make the instrument operational, the contractor shall contact the appropriate vendor (MESA Labs purchased BGI Incorporated in 2014) acquire a "Return/Repair Authorization Number," and ship it directly to that vender for a cost estimate of the repair. The cost estimate shall be forwarded to the EPA WAM who will approve and arrange for payment of the repair or postpone it. EPA will cover shipping through an existing contract with UPS.
C. The Metrology lab contractor shall perform NIST traceability certifications and provide appropriate certificates with the instruments.
D. Upon certification the Metrology lab contractor shall turn over the calibrators to OAQPS to post verify the calibrators prior to returning the instruments to their location of deployment. OAQPS will return the calibrators to the metrology laboratory with their results, which will be included in the annual report.
E. Identify calibrators and audit reference standards that are performing near and below the acceptable tolerance limits. Some instruments such as the BGI TriCal or TetraCal may perform outside of acceptance limits in operating ranges that are not likely to be encountered in the PEP program or other auditing activities. These instruments may be returned to field service, but advisories of their performance shall be sent to the personnel who use the instrument. If instruments are found to perform outside of the acceptance range the metrology lab shall consult with MESA Laboratories to determine if the instrument may be adjusted modulating the affected sensor's electronic signal. If adjustment is not possible the instrument shall be subject to the repair process in Task B above.
F. The Metrology Lab contractor shall make a hard copy of every certificate and include it with the instrument upon return to its location of deployment. Digital copies of the certificate shall be forwarded to the OAQPS PEP lead. A digital copy of all certificates shall also be maintained by the metrology lab. These copies may be stored for a period of 5 years.
G. Ensure all calibration/audit reference standards are shipped back to their location of deployment: EPA OAQPS AAMG, the appropriate EPA Region or their ESAT contractor, any other participating agency approved by the WAM. The OAQSP PEP lead will provide all contact information and shipping addresses.

<u>OBJECTIVE 4:</u> Document Results

- The Contractor shall compose and issue advisories (mentioned in Tasks 2B and 2E) to each EPA Regional Office PEP lead and their supporting contractor, or other EPA or Federal agency auditor, or other SLT contact who is responsible for, or utilizes a calibrator/audit device that has exhibited a performance outside of the acceptance limits for a given range of the measured parameter during the certification.
- The contractor shall compile an annual summary report of certification results and the details of the findings. The OAQPS PEP lead will provide a template of this document produced under previous contracts and work assignments.

WA SPECIFIC EQUIPMENT

Any equipment used in the Met Lab is shared among different work assignments and no equipment is specific to this work assignment.

QUALITY ASSURANCE

Quality Assurance for any individual instrument would fall under the QAPP for the program that the instrument is being used by.

DELIVERABLES

The Contractor shall provide the following reports for OAQPS:

(1) Monthly reports of the laboratory support activities including the following:

a) The number of and type of calibrations performed.
b) Any costs incurred during calibration activities.
c) Any maintenance activities performed.
d) Any documentation activities performed.

(2) Special reports as requested via a Technical Directive by the WACOR.

(3) The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be delivered on time because multiple projects have overloaded the ability of the laboratory, the WACOR shall be notified and then provide technical direction to the Contractor for prioritization.

(4) The WACOR shall be copied on all correspondence to and from any laboratories and venders used in the completion of the tasks associated with the projects. Any documents or literature during any of these correspondences will also be made available to the WACOR.

(5) The Contractor shall provide a Calibration Certificate for each device and give it to the Principle Investigator (PI) or to the Contractor Task Lead and keep a copy (either hard copy or electronic) on record.

(6) Formatting of reports shall be consistent with historical reporting and electronic files shall be compatible with Agency Standard Software. During EPA Fiscal Year 2015 (FY15) federal employees and Contractors will be using Windows 7 Enterprise, Adobe Reader 10 and Microsoft Office 2013. Any upgrades will be announce by OEI. Hard copies of reports are acceptable; however, electronic copies are encouraged.

SHEDULE OF DELIVERABLES

The contractor shall schedule each round of calibrations with OAQPS based on the next due date for calibration or availability of the equipment. The Contractor shall inform the WACOR and the OAQPS contact of any variance to the calibration schedule. All calibration reports would be

considered a deliverables. The Contractor shall provide all deliverables within 14 days after completing a calibration. Monthly reports shall be due at the same time the contractor invoiced EPA.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-031

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base X Option Period Number	1-031

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 1, 6

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Scott Moore	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-5104 FAX Number:
Project Officer Name: Robin Baily	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Mark Cranley	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

Performance Work Statement

WA Title: ITFB Metrology QA Laboratory Support

WA Short Title: ITFB Met Lab SUPT

WA #: 1-031 **WACOR:** Scott A. Moore

Contract #: EP-C-15-008 **ALT. WACOR:** Paul W. Groff

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from April 1, 2016 through March 31, 2017.

INTRODUCTION

Good Quality Assurance (QA) practice requires that routine operations in a research facility be conducted according to prescribed procedures and that data be of known and adequate quality. To ensure good QA, it is necessary that instrumentation be maintained in good working condition and that it be checked regularly to ensure that it produces reliable data. The Environmental Protection Agency (EPA) requires that QA practices be established and applied to all research measurement efforts. The Metrology Laboratory (Met Lab) provides QA assistance to EPA researchers by providing the procedures and the standards to calibrate various scientific devices.

SUMMARY OF OBJECTIVES

The objective of this Work Assignment (WA) is to provide Met Lab support to EPA researchers. The Met Lab is a facility with the capabilities to check (or audit) the calibration of EPA measurement instrumentation. A second objective is to provide support for preparing and verifying Performance Evaluation Audit (PEA) samples. The overall goal is to ensure and document that operations performed in EPA facilities produce data that will be of scientifically and legally defendable quality. This WA does not pertain to the calibration of facility devices such as smoke detectors, lights, or any health and safety related devices such as ambient Carbon Monoxide (CO) monitors that alarm strictly for safety reasons.

BACKGROUND

Data Uses:
Primary users of the products of this WA will be researchers and operators of equipment in the EPA facilities. The following divisions are currently using the Met Lab services:
The Air Pollution Prevention and Control Division (APPCD)

The National Health and Environmental Effects Research Laboratory (NHEERL)
The Office of Air Quality Planning and Standards (OAQPS)
The Decontamination and Consequence Management Division (DCMD)
The National Exposure Research Laboratory (NERL)

Calibration and PEA results can be reported in research reports to support or verify findings. All Quality Assurance Project Plans (QAPP) will be the responsibility of the project lead or principle investigator of the equipment being calibrated.

Lab Site: The Met Lab is located in rooms D360-A, D362 and D364-A in EPA's Research Center in Research Triangle Park, NC.

Experience: Personnel assigned to this WA must be capable of performing the tasks listed in each of the assigned Tasks, which include electrical work, plumbing, general experience with lab equipment and materials, a familiarity with the calibration of measurement devices and a fundamental understanding of the principals behind the measurements. Lab personnel will also require the ability to reduce data and report it according to the International Organization for Standardization (ISO) "General Requirements for the Competence of Calibration and Testing Laboratories" (ISO 17025) standard and the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM).

SCOPE

(1) The Met Lab was developed as a central means of providing the best practice for the calibration of laboratory equipment and at a low price by sharing those costs between various labs. The Contractor shall use their best practice in sharing the costs of equipment calibrations, repairs, system upgrades, purchases and labor hours evenly (based on volume of work) between all the WA issued pertaining to Metrology Support.

(2) The Contractor shall obtain performance specifications on potential calibration equipment. The Contractor shall maintain and upgrade calibration systems and equipment as needed. Final decisions regarding upgrading and replacing equipment will be relayed to the Contractor in a technical directive through the WA Contracting Officer Representative (WACOR).

(3) The Contractor shall maintain Met Lab equipment in proper working order. The Contractor shall identify calibration needs and ensure that the necessary factory equipment calibrations for the Met Lab equipment are kept up to date. The Contractor shall maintain a record of all maintenance activities. Whenever practically possible, the calibration data for this equipment shall include National Institute of Standards and Technology (NIST) traceable information.

(4) The Contractor shall perform measurement device and equipment calibrations that conform to ISO 17025 and the GUM. The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be

delivered on time because multiple projects have overloaded the ability of the laboratory, the WACOR will assign project priority.

(5) The Contractor shall begin the process of acquiring ISO 17025 Accreditation for the Met Lab. Details of the ISO 17025 Accreditation will be detailed in WA 1-041.

(6) The Contractor shall provide Technical Support for any Principle Investigator (PI) that may need assistance with projects that will need Met Lab support.

(7) The Contractor shall develop, document, and implement detailed calibration operating procedures for all laboratory calibration services.

(8) The Contractor shall assemble and maintain a system of published procedures and product information relevant to calibration measurement procedures and measurement devices.

(9) The Contractor shall confirm the current acceptable validation methods for all calibration systems used in the Met Lab and also for the calibration tracking system. Any confirmation of validation methods shall be documented. All database functions that are user-programmed shall be tested and the validation documented. Each revision to the database software (exclusive of the data in the database) shall have an identifiable revision number assigned to it.

TECHNICAL APPROACH/OBJECTIVES

OBJECTIVE 1: Recertification of ITFB's Analytical Balances

The Contractor shall recertify all analytical balances that are in active use and that have not been recertified within the past year. The Contractor shall contact the individual who has been identified as each balance's custodian to arrange for a date to recertify the balance. After each balance recertification, the Contractor shall update the Met Lab Database.

OBJECTIVE 2: Weight sets, Flows, Temperature, Pressure, Voltage and Relative Humidity (RH) Calibration Support

The Contractor shall calibrate/verify Weight sets, Flow devices, Temperature devices, Pressure devices, Voltage devices and RH Meters for ITFB Labs. The total number of ITFB devices is difficult to calculate due to instruments that are purchased, excessed or moved based on project activity. The Contractor shall use their best practice to accommodate as many of the calibrations as possible and inform the WACOR of any difficulties that may arise.

OBJECTIVE 3: ITFB Additional Calibration and Repairs

The Contractor shall calibrate other devices not on this list as labor hours will allow. There may be circumstances where the calibration (or repair) of an instrument is beyond the technical expertise of the Met Lab. If this occurs, the Contractor shall make the arrangements with the instrument vender to have the instrument repaired and /or recalibrated. The Contractor shall communicate with the WACOR the status of that instrument throughout that process.

OBJECTIVE 4: ITFB Calibration of Analytical Equipment

The Contractor shall perform equipment calibrations to the following list of devises:
a) 37 Flow devices
b) 11 Relative Humidity Probes
c) 3 Pressure devices
d) 4 Ozone Analyzers
e) Any other devise as needed

OBJECTIVE 7: ITFB Additional Calibration and Repairs.

The Contractor shall calibrate other devices not on this list as labor hours will allow. There may be circumstances where the calibration (or repair) of an instrument is beyond the technical expertise of the Met Lab. If this occurs, the Contractor shall make the arrangements with the instrument vender to have the instrument repaired and /or recalibrated. The Contractor shall communicate with the WACOR the status of that instrument throughout that process.

WA SPECIFIC EQUIPMENT

Any equipment used in the Met Lab is shared among different work assignments and no equipment is specific to this work assignment.

QUALITY ASSURANCE

Quality Assurance for any individual instrument would fall under the QAPP for the program that the instrument is being used by.

DELIVERABLES

The Contractor shall provide the following reports for APPCD:

(1) Monthly reports of the laboratory support activities including the following:

a) The number of and type of calibrations performed.

b) Any costs incurred during calibration activities.
c) Any maintenance activities performed.
d) Any documentation activities performed.
e) Status of the Facility Manuals.
f) Any other activities that would impact the operation of the Met Lab.

(2) Special reports as requested via a Technical Directive by the WACOR.

(3) The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be delivered on time because multiple projects have overloaded the ability of the laboratory, the WACOR shall be notified and then provide technical direction to the Contractor for prioritization.

(4) The WACOR shall be copied on all correspondence to and from any laboratories and venders used in the completion of the tasks associated with the projects. Any documents or literature during any of these correspondences will also be made available to the WACOR.

(5) The Contractor shall provide a Calibration Certificate for each device and give it to the Principle Investigator (PI) or to the Contractor Task Lead and keep a copy (either hard copy or electronic) on record.

(6) Formatting of reports shall be consistent with historical reporting and electronic files shall be compatible with Agency Standard Software. During EPA Fiscal Year 2015 (FY15) federal employees and Contractors will be using Windows 7 Enterprise, Adobe Reader 10 and Microsoft Office 2013. Any upgrades will be announce by OEI. Hard copies of reports are acceptable; however, electronic copies are encouraged.

SHEDULE OF DELIVERABLES

All calibration reports would be considered a deliverables. The Contractor shall provide all deliverables within 14 days after completing a calibration. Monthly reports shall be due at the same time the contractor invoiced EPA.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-031

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number 1

Title of Work Assignment/SF Site Name: ITFB Met QA Support

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: introduction - paragraph 1

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:
The purpose of this amendment is to revise the PWS. A technical memo and revised cost estimate are requested within 7 business days.

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2018 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee — LOE:

Cumulative Approved: — Cost/Fee — LOE:

Work Assignment Manager Name: Scott Moore
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-5104
FAX Number:

Project Officer Name: Robin S. Harris
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0955
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Candice Charlton
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2007
FAX Number:

Performance Work Statement

WA Title: ITFB Metrology QA Laboratory Support

WA Short Title: ITFB Met Lab SUPT

WA #: 1-031 **WACOR:** Scott A. Moore

Contract #: EP-C-15-008 **ALT. WACOR:** Paul W. Groff

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from April 1, 2016 through March 31, 2017.

AMENDMENT 1

EPA has acquired several pieces of equipment from NIEHS to use in their animal exposer facilities in RTP. The equipment has been sterilized by NIEHS but the proper documentation was not provided. EPA has a sterilization unit (called "The Commander") in the RTP H Building. The contractor may use "The Commander" for the equipment. Between the approval of this amendment and March 31, 2017 ITFB will supply up to eight batches of equipment to the contractor for sterilization.

The Contractor shall prepare each batch for proper sterilization, as specified in NHRC's QA Protocol.
The Contractor shall provide all documentation demonstrating the effectiveness of the sterilization process to ITFB.
The Contractor shall wrap the equipment in preparation of moving it back to the Animal Facilities in a manner that will prevent any cross contamination during the move.

END OF AMENDMENT 1

INTRODUCTION

Good Quality Assurance (QA) practice requires that routine operations in a research facility be conducted according to prescribed procedures and that data be of known and adequate quality. To ensure good QA, it is necessary that instrumentation be maintained in good working condition and that it be checked regularly to ensure that it produces reliable data. The Environmental Protection Agency (EPA) requires that QA practices be established and applied to all research measurement efforts. The Metrology Laboratory (Met Lab) provides QA assistance to EPA researchers by providing the procedures and the standards to calibrate various scientific devices.

SUMMARY OF OBJECTIVES

The objective of this Work Assignment (WA) is to provide Met Lab support to EPA researchers. The Met Lab is a facility with the capabilities to check (or audit) the calibration of EPA measurement instrumentation. A second objective is to provide support for preparing and verifying Performance Evaluation Audit (PEA) samples. The overall goal is to ensure and document that operations performed in EPA facilities produce data that will be of scientifically and legally defendable quality. This WA does not pertain to the calibration of facility devices such as smoke detectors, lights, or any health and safety related devices such as ambient Carbon Monoxide (CO) monitors that alarm strictly for safety reasons.

BACKGROUND

Data Uses:
Primary users of the products of this WA will be researchers and operators of equipment in the EPA facilities. The following divisions are currently using the Met Lab services:
The Air Pollution Prevention and Control Division (APPCD)
The National Health and Environmental Effects Research Laboratory (NHEERL)
The Office of Air Quality Planning and Standards (OAQPS)
The Decontamination and Consequence Management Division (DCMD)
The National Exposure Research Laboratory (NERL)

Calibration and PEA results can be reported in research reports to support or verify findings. All Quality Assurance Project Plans (QAPP) will be the responsibility of the project lead or principle investigator of the equipment being calibrated.

Lab Site: The Met Lab is located in rooms D360-A, D362 and D364-A in EPA's Research Center in Research Triangle Park, NC.

Experience: Pèrsonnel assigned to this WA must be capable of performing the tasks listed in each of the assigned Tasks, which include electrical work, plumbing, general experience with lab equipment and materials, a familiarity with the calibration of measurement devices and a fundamental understanding of the principals behind the measurements. Lab personnel will also require the ability to reduce data and report it according to the International Organization for Standardization (ISO) "General Requirements for the Competence of Calibration and Testing Laboratories" (ISO 17025) standard and the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM).

SCOPE

(1) The Met Lab was developed as a central means of providing the best practice for the calibration of laboratory equipment and at a low price by sharing those costs between various labs. The Contractor shall use their best practice in sharing the costs of equipment calibrations, repairs, system upgrades, purchases and labor hours evenly (based on volume of work) between all the WA issued pertaining to Metrology Support.

(2) The Contractor shall obtain performance specifications on potential calibration equipment. The Contractor shall maintain and upgrade calibration systems and equipment as needed. Final decisions regarding upgrading and replacing equipment will be relayed to the Contractor in a technical directive through the WA Contracting Officer Representative (WACOR).

(3) The Contractor shall maintain Met Lab equipment in proper working order. The Contractor shall identify calibration needs and ensure that the necessary factory equipment calibrations for the Met Lab equipment are kept up to date. The Contractor shall maintain a record of all maintenance activities. Whenever practically possible, the calibration data for this equipment shall include National Institute of Standards and Technology (NIST) traceable information.

(4) The Contractor shall perform measurement device and equipment calibrations that conform to ISO 17025 and the GUM. The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be delivered on time because multiple projects have overloaded the ability of the laboratory, the WACOR will assign project priority.

(5) The Contractor shall begin the process of acquiring ISO 17025 Accreditation for the Met Lab. Details of the ISO 17025 Accreditation will be detailed in WA 1-041.

(6) The Contractor shall provide Technical Support for any Principle Investigator (PI) that may need assistance with projects that will need Met Lab support.

(7) The Contractor shall develop, document, and implement detailed calibration operating procedures for all laboratory calibration services.

(8) The Contractor shall assemble and maintain a system of published procedures and product information relevant to calibration measurement procedures and measurement devices.

(9) The Contractor shall confirm the current acceptable validation methods for all calibration systems used in the Met Lab and also for the calibration tracking system. Any confirmation of validation methods shall be documented. All database functions that are user-programmed shall be tested and the validation documented. Each revision to the database software (exclusive of the data in the database) shall have an identifiable revision number assigned to it.

TECHNICAL APPROACH/OBJECTIVES

OBJECTIVE 1: Recertification of ITFB's Analytical Balances

The Contractor shall recertify all analytical balances that are in active use and that have not been recertified within the past year. The Contractor shall contact the individual who has been identified as each balance's custodian to arrange for a date to recertify the balance. After each balance recertification, the Contractor shall update the Met Lab Database.

OBJECTIVE 2: Weight sets, Flows, Temperature, Pressure, Voltage and Relative Humidity (RH) Calibration Support

The Contractor shall calibrate/verify Weight sets, Flow devices, Temperature devices, Pressure devices, Voltage devices and RH Meters for ITFB Labs. The total number of ITFB devices is difficult to calculate due to instruments that are purchased, excessed or moved based on project activity. The Contractor shall use their best practice to accommodate as many of the calibrations as possible and inform the WACOR of any difficulties that may arise.

OBJECTIVE 3: ITFB Additional Calibration and Repairs

The Contractor shall calibrate other devices not on this list as labor hours will allow. There may be circumstances where the calibration (or repair) of an instrument is beyond the technical expertise of the Met Lab. If this occurs, the Contractor shall make the arrangements with the instrument vender to have the instrument repaired and /or recalibrated. The Contractor shall communicate with the WACOR the status of that instrument throughout that process.

OBJECTIVE 4: ITFB Calibration of Analytical Equipment

The Contractor shall perform equipment calibrations to the following list of devises:
a) 37 Flow devices
b) 11 Relative Humidity Probes
c) 3 Pressure devices
d) 4 Ozone Analyzers
e) Any other devise as needed

OBJECTIVE 7: ITFB Additional Calibration and Repairs.

The Contractor shall calibrate other devices not on this list as labor hours will allow. There may be circumstances where the calibration (or repair) of an instrument is beyond

the technical expertise of the Met Lab. If this occurs, the Contractor shall make the arrangements with the instrument vender to have the instrument repaired and /or recalibrated. The Contractor shall communicate with the WACOR the status of that instrument throughout that process.

WA SPECIFIC EQUIPMENT

Any equipment used in the Met Lab is shared among different work assignments and no equipment is specific to this work assignment.

QUALITY ASSURANCE

Quality Assurance for any individual instrument would fall under the QAPP for the program that the instrument is being used by.

DELIVERABLES

The Contractor shall provide the following reports for APPCD:

(1) Monthly reports of the laboratory support activities including the following:

a) The number of and type of calibrations performed.
b) Any costs incurred during calibration activities.
c) Any maintenance activities performed.
d) Any documentation activities performed.
e) Status of the Facility Manuals.
f) Any other activities that would impact the operation of the Met Lab.

(2) Special reports as requested via a Technical Directive by the WACOR.

(3) The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be delivered on time because multiple projects have overloaded the ability of the laboratory, the WACOR shall be notified and then provide technical direction to the Contractor for prioritization.

(4) The WACOR shall be copied on all correspondence to and from any laboratories and venders used in the completion of the tasks associated with the projects. Any documents or literature during any of these correspondences will also be made available to the WACOR.

(5) The Contractor shall provide a Calibration Certificate for each device and give it to the Principle Investigator (PI) or to the Contractor Task Lead and keep a copy (either hard copy or electronic) on record.

(6) Formatting of reports shall be consistent with historical reporting and electronic files shall be compatible with Agency Standard Software. During EPA Fiscal Year 2015 (FY15) federal employees and Contractors will be using Windows 7 Enterprise, Adobe Reader 10 and Microsoft Office 2013. Any upgrades will be announce by OEI. Hard copies of reports are acceptable; however, electronic copies are encouraged.

SHEDULE OF DELIVERABLES

All calibration reports would be considered a deliverables. The Contractor shall provide all deliverables within 14 days after completing a calibration. Monthly reports shall be due at the same time the contractor invoiced EPA.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-032

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base X Option Period Number	1-032 NHEERL MED QA

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 1,6

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:
The LOE is high in contrast to the funds b/c much ODC's are the largest part of the WA cost.

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Scott Moore (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-5104 FAX Number:	
Project Officer Name Robin Baily (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:	
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:	
Contracting Official Name Mark Cranley (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109	

Performance Work Statement

WA Title: NHEERL MED Metrology QA Laboratory Support

WA Short Title: MED Met Lab SUPT

WA #: 1-032 **WACOR:** Scott A. Moore

Contract #: EP-C-15-008 **ALT. WACOR:** Paul W. Groff

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from April 1, 2016 through March 31, 2017.

INTRODUCTION

Good Quality Assurance (QA) practice requires that routine operations in a research facility be conducted according to prescribed procedures and that data be of known and adequate quality. To ensure good QA, it is necessary that instrumentation be maintained in good working condition and that it be checked regularly to ensure that it produces reliable data. The Environmental Protection Agency (EPA) requires that QA practices be established and applied to all research measurement efforts. The Metrology Laboratory (Met Lab) provides QA assistance to EPA researchers by providing the procedures and the standards to calibrate various scientific devices.

SUMMARY OF OBJECTIVES

The objective of this Work Assignment (WA) is to provide Met Lab support to EPA researchers. The Met Lab is a facility with the capabilities to check (or audit) the calibration of EPA measurement instrumentation. A second objective is to provide support for preparing and verifying Performance Evaluation Audit (PEA) samples. The overall goal is to ensure and document that operations performed in EPA facilities produce data that will be of scientifically and legally defendable quality. This WA does not pertain to the calibration of facility devices such as smoke detectors, lights, or any health and safety related devices such as ambient Carbon Monoxide (CO) monitors that alarm strictly for safety reasons.

BACKGROUND

Data Uses:
Primary users of the products of this WA will be researchers and operators of equipment in the EPA facilities. The following divisions are currently using the Met Lab services:
The Air Pollution Prevention and Control Division (APPCD)

The National Health and Environmental Effects Research Laboratory (NHEERL)
The Office of Air Quality Planning and Standards (OAQPS)
The Decontamination and Consequence Management Division (DCMD)
The National Exposure Research Laboratory (NERL)

Calibration and PEA results can be reported in research reports to support or verify findings. All Quality Assurance Project Plans (QAPP) will be the responsibility of the project lead or principle investigator of the equipment being calibrated.

Lab Site: The Met Lab is located in rooms D360-A, D362 and D364-A in EPA's Research Center in Research Triangle Park, NC.

Experience: Personnel assigned to this WA must be capable of performing the tasks listed in each of the assigned Tasks, which include electrical work, plumbing, general experience with lab equipment and materials, a familiarity with the calibration of measurement devices and a fundamental understanding of the principals behind the measurements. Lab personnel will also require the ability to reduce data and report it according to the International Organization for Standardization (ISO) "General Requirements for the Competence of Calibration and Testing Laboratories" (ISO 17025) standard and the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM).

SCOPE

(1) The Met Lab was developed as a central means of providing the best practice for the calibration of laboratory equipment and at a low price by sharing those costs between various labs. The Contractor shall use their best practice in sharing the costs of equipment calibrations, repairs, system upgrades, purchases and labor hours evenly (based on volume of work) between all the WA issued pertaining to Metrology Support.

(2) The Contractor shall obtain performance specifications on potential calibration equipment. The Contractor shall maintain and upgrade calibration systems and equipment as needed. Final decisions regarding upgrading and replacing equipment will be relayed to the Contractor in a technical directive through the WA Contracting Officer Representative (WACOR).

(3) The Contractor shall maintain Met Lab equipment in proper working order. The Contractor shall identify calibration needs and ensure that the necessary factory equipment calibrations for the Met Lab equipment are kept up to date. The Contractor shall maintain a record of all maintenance activities. Whenever practically possible, the calibration data for this equipment shall include National Institute of Standards and Technology (NIST) traceable information.

(4) The Contractor shall perform monthly Quality Assurance and/or Quality Control QA/QC checks of the X-ray Fluorescence (XRF) in Room E360. The Contractor shall assist Principle Investigators (PI) with scheduling XRF usage, sample preparation and

analysis of collected samples. The Contractor will inform the WACOR of any scheduling conflicts and of any non-routine maintenance issues.

(5) The Contractor shall perform measurement device and equipment calibrations that conform to ISO 17025 and the GUM. The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be delivered on time because multiple projects have overloaded the ability of the laboratory, the WACOR will assign project priority.

(6) The Contractor shall begin the process of acquiring ISO 17025 Accreditation for the Met Lab. Details of the ISO 17025 Accreditation will be detailed in WA 1-041.

(7) The Contractor shall provide Technical Support for any Principle Investigator (PI) that may need assistance with projects that will need Met Lab support.

(8) The Contractor shall develop, document, and implement detailed calibration operating procedures for all laboratory calibration services.

(9) The Contractor shall assemble and maintain a system of published procedures and product information relevant to calibration measurement procedures and measurement devices.

(10) The Contractor shall confirm the current acceptable validation methods for all calibration systems used in the Met Lab and also for the calibration tracking system. Any confirmation of validation methods shall be documented. All database functions that are user-programmed shall be tested and the validation documented. Each revision to the database software (exclusive of the data in the database) shall have an identifiable revision number assigned to it.

TECHNICAL APPROACH/OBJECTIVES

OBJECTIVE 1: NHEERL Mid-Continent Ecology Division (MED) Met Lab Support

The Contractor shall select a Designated Specialist (DS) for pipette calibrations that conform to the NHEERL-MED Calibration SOPs or ISO 17025 and the GUM. These devices shall be calibrated on site or mailed to the DS. NHEERL-MED will pack and mail (via any carrier at the discretion of NHEERL-MED) all of the devices (i.e. pipettes) to be calibrated to the DS. NHEERL-MED will be responsible for all shipping charges. The Contractor shall maintain a record and data base of all equipment calibrations and calibration schedules. NHEERL-MED will have 600 pipettes be calibrated via the Met Lab. NHEERL-MED would like to maintain a schedule of calibrating 150 pipettes (or ¼ of their total volume) every 3 months.

WA SPECIFIC EQUIPMENT

Any equipment used in the Met Lab is shared among different work assignments and no equipment is specific to this work assignment.

QUALITY ASSURANCE

Quality Assurance for any individual instrument would fall under the QAPP for the program that the instrument is being used by.

DELIVERABLES

The Contractor shall provide the following reports for NHEERL MED:

(1) Monthly reports of the laboratory support activities including the following:

a) The number of pipette calibrations performed.
b) Any costs incurred during calibration activities.
c) Any maintenance activities performed.
d) Any documentation activities performed.

(2) The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be delivered on time because multiple projects have overloaded the ability of the laboratory, the WACOR shall be notified and then provide technical direction to the Contractor for prioritization.

(3) The WACOR shall be copied on all correspondence to and from any laboratories and venders used in the completion of the tasks associated with the projects. Any documents or literature during any of these correspondences will also be made available to the WACOR.

(4) The Contractor shall provide a Calibration Certificate for each device and give it to the Principle Investigator (PI) or to the Contractor Task Lead and keep a copy (either hard copy or electronic) on record.

(5) Formatting of reports shall be consistent with historical reporting and electronic files shall be compatible with Agency Standard Software. During EPA Fiscal Year 2015 (FY15) federal employees and Contractors will be using Windows 7 Enterprise, Adobe Reader 10 and Microsoft Office 2013. Any upgrades will be announce by OEI. Hard copies of reports are acceptable; however, electronic copies are encouraged.

SHEDULE OF DELIVERABLES

All calibration reports would be considered a deliverables. The Contractor shall provide all deliverables within 14 days after completing a calibration. Monthly reports shall be due at the same time the contractor invoiced EPA.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-033

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008	Contract Period 04/01/2015 To 03/31/2017 Base X Option Period Number	Title of Work Assignment/SF Site Name: 1-033
Contractor: JACOBS TECHNOLOGY INC.	Specify Section and paragraph of Contract SOW: 1, 6	

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Scott Moore	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-5104 FAX Number:
Project Officer Name: Robin Baily	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Mark Cranley	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

Performance Work Statement

WA Title: OZONE Metrology QA Laboratory Support

WA Short Title: OZONE Met Lab SUPT

WA #: 1-033 **WACOR:** Scott A. Moore

Contract #: EP-C-15-008 **ALT. WACOR:** Paul W. Groff

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement of (PWS) shall be from April 1, 2016 through March 31, 2017.

INTRODUCTION

Good Quality Assurance (QA) practice requires that routine operations in a research facility be conducted according to prescribed procedures and that data be of known and adequate quality. To ensure good QA, it is necessary that instrumentation be maintained in good working condition and that it be checked regularly to ensure that it produces reliable data. The Environmental Protection Agency (EPA) requires that QA practices be established and applied to all research measurement efforts. The Metrology Laboratory (Met Lab) provides QA assistance to EPA researchers by providing the procedures and the standards to calibrate various scientific devices.

SUMMARY OF OBJECTIVES

The objective of this Work Assignment (WA) is to provide Met Lab support to EPA researchers. The Met Lab is a facility with the capabilities to check (or audit) the calibration of EPA measurement instrumentation. A second objective is to provide support for preparing and verifying Performance Evaluation Audit (PEA) samples. The overall goal is to ensure and document that operations performed in EPA facilities produce data that will be of scientifically and legally defendable quality. This WA does not pertain to the calibration of facility devices such as smoke detectors, lights, or any health and safety related devices such as ambient Carbon Monoxide (CO) monitors that alarm strictly for safety reasons.

BACKGROUND

Data Uses:
Primary users of the products of this WA will be researchers and operators of equipment in the EPA facilities. The following divisions are currently using the Met Lab services:
The Air Pollution Prevention and Control Division (APPCD)

The National Health and Environmental Effects Research Laboratory (NHEERL)
The Office of Air Quality Planning and Standards (OAQPS)
The Decontamination and Consequence Management Division (DCMD)
The National Exposure Research Laboratory (NERL)

Calibration and PEA results can be reported in research reports to support or verify findings. All Quality Assurance Project Plans (QAPP) will be the responsibility of the project lead or principle investigator of the equipment being calibrated.

Lab Site: The Met Lab is located in rooms D360-A, D362 and D364-A in EPA's Research Center in Research Triangle Park, NC.

Experience: Personnel assigned to this WA must be capable of performing the tasks listed in each of the assigned Tasks, which include electrical work, plumbing, general experience with lab equipment and materials, a familiarity with the calibration of measurement devices and a fundamental understanding of the principals behind the measurements. Lab personnel will also require the ability to reduce data and report it according to the International Organization for Standardization (ISO) "General Requirements for the Competence of Calibration and Testing Laboratories" (ISO 17025) standard and the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM).

SCOPE

(1) The Met Lab was developed as a central means of providing the best practice for the calibration of laboratory equipment and at a low price by sharing those costs between various labs. The Contractor shall use their best practice in sharing the costs of equipment calibrations, repairs, system upgrades, purchases and labor hours evenly (based on volume of work) between all the WAs issued pertaining to Metrology Support.

(2) The Contractor shall obtain performance specifications on potential calibration equipment. The Contractor shall maintain and upgrade calibration systems and equipment as needed. Final decisions regarding upgrading and replacing equipment will be relayed to the Contractor in a technical directive through the WA Contracting Officer Representative (WACOR).

(3) The Contractor shall maintain Met Lab equipment in proper working order. The Contractor shall identify calibration needs and ensure that the necessary factory equipment calibrations for the Met Lab equipment are kept up to date. The Contractor shall maintain a record of all maintenance activities. Whenever practically possible, the calibration data for this equipment shall include National Institute of Standards and Technology (NIST) traceable information.

(5) The Contractor shall perform measurement device and equipment calibrations that conform to ISO 17025 and the GUM. The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be

delivered on time because multiple projects have overloaded the ability of the laboratory, the WACOR will assign project priority.

(6) The Contractor shall begin the process of acquiring ISO 17025 Accreditation for the Met Lab. Details of the ISO 17025 Accreditation will be detailed in WA 1-041.

(7) The Contractor shall provide Technical Support for any Principle Investigator (PI) that may need assistance with projects that will need Met Lab support.

(8) The Contractor shall develop, document, and implement detailed calibration operating procedures for all laboratory calibration services.

(9) The Contractor shall assemble and maintain a system of published procedures and product information relevant to calibration measurement procedures and measurement devices.

(10) The Contractor shall confirm the current acceptable validation methods for all calibration systems used in the Met Lab and also for the calibration tracking system. Any confirmation of validation methods shall be documented. All database functions that are user-programmed shall be tested and the validation documented. Each revision to the database software (exclusive of the data in the database) shall have an identifiable revision number assigned to it.

TECHNICAL APPROACH/OBJECTIVES

<u>OBJECTIVE 1:</u> Standard Reference Photometer (SRP) Ozone Support

(1) The Contractor shall receive an Ozone measuring devise and unpack the equipment to be set it up to run against EPA's Primary Standard Reference Photometer serial number 01 (SRP-01). The designated Lab is D360-A.

(2) The Contractor shall break down an Ozone measuring devise in preparation for shipping it back to the specific owner

(3) The Contractor shall perform repairs on the SRPs as per Technical Directives from the WACOR. The Contractor shall copy any data recored to the EPA Server for safe storage.

(5) The Contractor shall run QA/QC Checks, Verifications, Re-Verifications and Calibrations on any Guest Ozone standards.

(6) The Contractor shall maintain the Zero Air Supply used for the Ozone Lab.

(7) The Contractor shall maintain a calibration schedule for various support instrumentation such as the Barometric Pressure Sensor, the STOLAB Temperature calibrator and the Fluke Digital Volt Meter.

(8) The Contractor shall perform QA evaluations using Excel and Word templates provided with the SRP Software.

(9) The Contractor shall provide the WACOR with documentation on any calibration that is performed for final approval and before it is released to any other entity.

(10) The WACOR shall be copied on all correspondence to and from any laboratories and venders used in the completion of the tasks associated with the projects. Any documents or literature during any of these correspondences will also be made available to the WACOR.

(11) The Contractor shall be responsible for the annual re-verification of SRP-01, which is performed by NIST. The WACOR will issue a TD concerning details of the re-verification of SRP-01.

WA SPECIFIC EQUIPMENT

Any equipment used in the Met Lab is shared among different work assignments and no equipment is specific to this work assignment.

QUALITY ASSURANCE

Quality Assurance for any individual instrument would fall under the QAPP for the program that the instrument is being used by.

DELIVERABLES

The Contractor shall provide the following reports for APPCD:

(1) Monthly reports of the laboratory support activities including the following:

a) The number of and type of calibrations performed.
b) Any maintenance activities performed.
c) Any documentation activities performed.
d) Any other activities that would impact the operation of the Met Lab.

(2) Special reports as requested via a Technical Directive by the WACOR.

(3) The Contractor shall respond to calibration needs by giving priority to projects that have time constraints. If calibrations cannot be delivered on time because multiple projects have overloaded the ability of the laboratory, the WACOR shall be notified and then provide technical direction to the Contractor for prioritization.

(4) The WACOR shall be copied on all correspondence to and from any laboratories and venders used in the completion of the tasks associated with the projects. Any documents or literature during any of these correspondences will also be made available to the WACOR.

(5) Formatting of reports shall be consistent with historical reporting and electronic files shall be compatible with Agency Standard Software. During EPA Fiscal Year 2015 (FY15) federal employees and Contractors will be using Windows 7 Enterprise, Adobe Reader 10 and Microsoft Office 2013. Any upgrades will be announce by OEI. Hard copies of reports are acceptable; however, electronic copies are encouraged.

SHEDULE OF DELIVERABLES

All calibration reports would be considered a deliverables. The Contractor shall provide all deliverables within 14 days after completing a calibration. Monthly reports shall be due at the same time the contractor invoiced EPA.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-034

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base X Option Period Number	1-034

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 4, 6

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Thomas Long	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3944 FAX Number:
Project Officer Name Robin Baily	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:
Other Agency Official Name	(Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Mark Cranley	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Mobile Source Emissions Measurement and Characterization

WA #: 1-034 WACOR: Thomas Long

Contract #: EP-C-15-008 Alternate WACOR: Richard Baldauf

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

Generate emissions data from three vehicles satisfying Office of Transportation and Air Quality requirements for new Motor Vehicle Emission Simulator (MOVES), TBD. Chassis dynamometer driving cycles will consist of one Federal Test Protocol (http://www.epa.gov/otaq/emisslab/methods/huddscol.txt) and three repetitions of a locally developed cycle which is approximately 20 minutes in duration. These driving cycles will be repeated until nine valid (see below) data sets are created. On road measurements with a PEMS unit will be made over the road. Each set of routes is expected to be completed in one working day. A set of three routes is to be repeated by all three vehicles four times.

BACKGROUND

This project directly addresses the air, climate, and human health program areas, and supports other motor vehicle projects. While the two currently regulated "critical pollutants", particulate matter (0.01 grams per brake-horsepower-hour (g/bhp-hr)) and NOx (0.20 g/bhp-hr) impact air quality and related health issues, proposed new rules focus on two related areas with broader environmental and social effects: vehicle fuel economy and greenhouse gas (GHG) emissions. The two go hand-in-hand because burning carbon-based petroleum fuels creates carbon emissions, so improving fuel economy directly lowers an internal combustion engine's main GHG, carbon dioxide (CO2).

New vehicle rules are being phased in between 2014 and 2018 as part of an overall energy strategy that looks to reduce U.S. dependency on foreign energy supplies and lower CO2 creation to address global warming concerns.

It is estimated that commercial trucks consume more than 2-million barrels of oil every day and account for 20% of transportation-related GHGs. For example, the

state of California estimates that diesel trucks are responsible for seven and a half percent of all of California's global warming pollution.

The call for truck rules does not come with specific target numbers, but requires EPA, with the aid of the National Highway Transportation Safety Administration (NHTSA) to set standards based on research data. Much of the guidance for determining the standards will come from a congressionally mandated report. Created under the auspices of the National Research Council (NRC), "Technologies and Approaches Reducing the Fuel Consumption of Medium- and Heavy-Duty Vehicles" was put together by a 19-member panel that combined academic researchers, engineers, and technologists with backgrounds in truck and component manufacturing.

Given the size of the existing database for emissions from either Medium Heavy-Duty Trucks (MHDT) or gas direct injection (GDI) vehicles, this study hopes to provide insight into whether it is necessary to modify MOVES to improve these emission factors or to fill similar gaps in represented emission factors.

SCOPE

This Work Assignment (WA) has been designed to fill data gaps or improve existing emission factors for the use case of MHDT or GDI (or similar missing emission factors to be specified by OTAQ).

- Testing will be conducted on either three MHDT or three GDI vehicles. MHDT vehicles will be tested under both laden, 90% Gross Vehicle Combined Weight Rating (GCWR) and unladen (50% GVWR) conditions. GDI vehicles will be tested at ambient temperatures of 72 °F (22 °C) and 20 °F (-7 °C).
- On road routes are local. Two of the routes are in Chapel Hill and one is in Hillsborough. Considerations included a protracted grade and varying traffic conditions in each of the speed ranges 0 to 25 mph, 25 to 50 mph, and above 50 mph. Due to fueling and travel considerations, all routes must be completed in a 5 hour time frame, including one half hour for the drivers to eat lunch.
- Chassis dynamometer test cycles will include a cold start FTP followed by three warm start Mobile Source Distributed Power Driving Schedules designed to generate data in each of the operating modes represented in the MOVES model.
- Core dynamometer bench measurements will include Total hydrocarbon (THC), non-methane hydrocarbons (NMHC), non-methane organic gas (NMOG), oxides of nitrogen (NOx), nitrogen dioxide (NO2), carbon monoxide (CO), carbon dioxide (CO2) and particulate matter (PM)

- Core portable emissions measurement system (PEMS) measurements will include Total hydrocarbon (THC), nitrogen oxide (NO), oxides of nitrogen (NOx), nitrogen dioxide (NO2), carbon monoxide (CO), and carbon dioxide (CO2)
- Chassis dynamometer testing shall also generate speciated volatile organic compound (speciated VOC) data. VOC compounds

TECHNICAL APROACH/OBJECTIVES

Task 3 Test Fuels and Lubricants

The Contractor will be required to provide test fuel. Fuel will conform to the requirements stated in the each vehicle's operating manual and be procured from the distributor as a single batch. The Contractor will provide speciated analyses of the fuels sampled before and after project emissions testing and speciated analysis of the lubricant sampled after project emissions testing.

Task 4 Vehicle Procurement and Preparation

The Contractor shall be required to provide three test vehicles. Two will be driven on-road by Contractor personnel. The other one will be driven on-road by government personnel. All three will be driven on the chassis dynamometer by government personnel.

Each vehicle to be tested shall undergo a thorough inspection before beginning the test preparation sequence. This includes inspection and documentation of the engine, transmission, axles, exhaust system and tires, and documentation of the ECM status. Descriptively titled photographs of the vehicles' exhaust systems, engine plates, and emission plates shall be taken and included as part of the progress and final reports. The Contractor shall collect and record vehicle information as described in the Quality Assurance Project Plan (QAPP). Preparation will include assisting with the performance of on-road coastdowns.

Each vehicle shall then undergo initial crankcase oil, oil filter and air filter replacement. Oil and air filters shall be procured by the Contractor according to manufacturer's recommendations. Engine oil recommended in the owner's manual of each vehicle shall be used. The recommended grade of lubricant shall be purchased.

After the last test of each vehicle in the program, the Contractor shall record the lubricant level indicated on the dipstick before collecting a 0.25-quart oil sample for analysis.

If any of the vehicles are equipped with traction control, the Contractor shall ensure that the traction control is disabled either through an interior disable button or other method (remove power fuse to anti-lock brake system (ABS), and place a placard in the vehicle indicating the method of disabling traction control if driver input is required.. The Contractor will be provided target road load coefficients and set road load coefficients for the test vehicles according to 40 CFR 1066.301 and 40 CFR 1066.310 (or the Contractor may propose and use an alternate method, subject to approval by EPA). For the purpose of this study, the agreed road load setting shall remain the same for all testing on a given vehicle.

The Contractor shall provide hardware and software for reading and archiving vehicle engine control module (ECM) data during emissions testing.

Task 5 Vehicle Testing

5.1 Basic Testing Protocol

The basic dynamometer testing protocol begins with a cold start Federal Test Protocol (FTP), followed by three warm start Mobile Source Distributed Power Driving Schedules (MSDPDS). For GDI light-duty vehicles (LDV) this protocol will be conducted in compliance with CFR Part 86 Subpart C, CFR Part 1065, and CFR part 1066. For MHDT the HD-UDDS will be conducted in compliance with CFR Part 86 Subpart N, and CFR Part 1065. This test sequence will be repeated for each vehicle. For MHDT, this test sequence will be performed in both the laden and unladen conditions. For GDI LDVs, this test sequence will be performed at ambient temperatures of 72 °F (22 °C) and 20 °F (-7 °C). Each test condition will be run on each vehicle at least three times. A fourth test may be run if necessary as described in 5.1.1. MHDT tests will be performed on the 72-inch single roll electric heavy-duty chassis dynamometer. GDI LDV tests will be performed on the 48-inch single roll electric light-duty chassis dynamometer. The EPA will provide the same driver to be used for all tests on a given vehicle.

The gaseous emissions to be measured and reported are THC, CH4, NOx, NO2, CO, and CO2. The Contractor will use cleaned SUMMA cans (provided by the EPA) to collect sample from which the US EPA will speciate the VOCs. The Contractor shall

speciate the oxygenates. The Contractor will provide polyurethane foam (PUF) sorbent plugs and collect samples on which the US EPA will conduct PAH analyses. The Contractor will provide teflon filters for the EPA to perform metals analysis on the runs made on the chassis dynamometer. The Contractor will provide DNPH cartridges and collect samples on which the US EPA will conduct carbonyl analyses. The Contractor will provide teflon filters on which the the US EPA will collect samples and perform gravimetric analyses.

During all emission tests, the Contractor shall record the following ECM parameters at the rate of 1 Hz using Contractor-supplied data acquisition equipment:

- RPM
- Vehicle speed
- Engine load
- MIL status
- Absolute throttle position
- Engine coolant temperature
- Short term fuel trim-bank 2
- Long term fuel trim-bank 2
- Fuel/air commanded equivalence ratio
- Alcohol fuel percent
- Manifold absolute pressure
- Spark advance
- PID Control Module Voltage
- Air Flow Rate From Mass Air Flow Sensor

The facilities for testing shall be maintained in conformance with the requirements of 40 CFR Part 86 Subparts C and N and 40 CFR Part 1066 as they apply to vehicle emissions testing. THC, CH4, NOx, NO2, CO, and CO2 emissions sampling and measurement shall be conducted as specified in 40 CFR 1065. The minimum detection limit for NO2, measurements shall be 5 ppb. If some aspect of testing will need to be done in variance to the above specifications the Contractor shall describe why that is the case and how it may impact the test results. Variances must be approved by the EPA WAM before testing may begin.

The Contractor shall verify that the tunnel flow remained constant during the test. The CVS blower shall be kept on for ½ hour before the first emission test on a given day and continuously between emission tests to ensure tunnel stability.

The Contractor shall provide defined and maintained cooling fan placement and flow for each test vehicle on all the tests. The flow of air sweeping the vehicle in the test cell shall be consistent between tests.

The Contractor shall perform "blank" UDDS tests at one month intervals during this program. These tests will involve running the full test sequence drawing only background air into the sampling system. All sampling systems will be operated and measurements will include:

- Phase level THC, CH4, CO, NOx, CO2, PM, NO2, VOCs (including alcohols and carbonyls)
- Continuous THC, CH4, CO, CO2 and NOx

The Contractor is not expected to provide a technician to support the three weeks of PEMS testing but the vehicle leases will need to span the duration from test preparation at the beginning of April 1, 2015 through the end of September 2016 to allow for the vehicles to be used for onroad testing by EPA personnel.

5.2 Speciation of Volatile Organic Compounds (VOCs), Dynamometer Tests

Sampling and analysis of alcohols shall be done using CARB method 1001, "Determination of Alcohols in Automotive Source Samples by Gas Chromatography" as modified by the MOP included in the QAPP. Sampling and analysis will be the responsibility of the Contractor.

Sampling and analysis of carbonyl compounds shall be done using TO-11a. Carbonyl sampling is to be performed by the Contractor. Carbonyl analysis will be performed by the EPA.

The Contractor shall seal and store alcohol samples at a temperature below 40oF immediately following collection. The Contractor shall make every effort to analyze these samples on the day they are collected, but no later than within six calendar days.

The Contractor shall provide segregated storage for alcohol and carbonyl samples to prevent their contamination.

No more than one vehicle shall be tested on the chassis dynamometer per test day, unless the Contractor can demonstrate that the total number of vehicles tested on that day and the timing of their tests will not compromise the time limit requirements imposed on sample analyses.

5.3 (Reserved)

5.4 PM measurement and Analysis

For tests on the chassis dynamometer, PM shall be collected on a Teflon filter and quartz filter for mass determination and subsequent chemical analysis. The sampling method shall allow for the collection of sufficient sample for chemical analyses. PM mass will be measured as specified in 40 CFR Part 1065. Two parallel filters will also be collect samples for each phase. Testing will be conducted collecting PM samples in parallel. One set of filters will be at the cerfication filter face velocity of 100 cm/s and the other will be set to alternate speeds as specified by OTAQ. Other deviations from this method will require approval from EPA.

Task 6 Coordination and Support of Non-regulated Emissions Measurements

6.1 UV-DOAS Instrument

(Reserved)

6.2 FTIR

Coordinate with Edgar Thompson as he conducts FTIR measurements from a probe into the dilution tunnel.

6.3 PAH

Coordinate with Michael Hays to provide sufficient media to sample PAH's for 3 of the five sample phases per test. This will include use of alternate absorbents to polyurethane foam (PUF).

6.4 VOC

Coordinate with Tom Long or designee to use sufficient clean and prepared SUMMA cans for VOC analysis for all five sample phases per test.

6.5 Metals

Coordinate with Michael Hays to provide sufficient media for metals analysis on two of the five sample phases per test.

Task 7 Deliverables

7.1 Work Plan

The Contractor shall submit a work plan for this Work Assignment.

7.2 Infrastructure Support Allocation Report

The Contractor shall provide a report detailing the resources from this work assignment apportioned to support of Task 8. This report is not to exceed one page of narrative providing the amount of ODC and LOE expended to support Task 8 and a brief statement of what was accomplished.

7.3 (Reserved)

7.4 Monthly Reports

The Contractor shall provide monthly progress reports and invoices in accordance with contract. See the Reports of Work, EPAAR clause 1552.211-70, Submission of Invoices, EPAAR clause 1552.232-70.

Taske 8 Mobile Source Dynamometer Research Laboratory Infrastructure Support

(to be priced separately)

In fulfillment of the objective of this task, the following Subtasks shall be performed by the Contractor, and throughout the course of performing these Subtasks, the Contractor shall comply with the most recent Mobile Source Emissions Measurement and Characterization Quality Assurance Project Plan (QAPP) and the SOP for the dynamometer or PEMS to be used that week. Total cost of LOE and ODC to complete Task 8 shall not exceed $115,000.

8.1.1 The Contractor shall prepare and operate the dynamometer, analytical bench, CVS sampling system and Portable Emissions Measurement Systems in accordance with the CFR and laboratory protocols established by the EPA. Variances are permitted only by technical direction and/or approval of the WAM.

8.1.2 The Contractor will perform instrument/equipment evaluations and repairs as necessary to demonstrate and maintain proper operability and will assist in facility/equipment problem resolution

8.1.3 The Contractor shall acquire supplies, consumables, and calibration/reference materials needed to assess regulated emissions, PM2.5, carbonyls, VOCs, SVOCs, MSATs, and oxygenates. Gas standards will be procured from Scott Specialty Gases or a vendor whose compliance with EPA standards has been shown to be statistically equivalent.

8.1.4 The Contractor shall forward the raw data to the WAM on the day the samples are taken.

8.1.5 Quality assurance forms provided by the WAM to the Contractor will be completed in accordance with WAM technical direction. An electronic copy (PDF) will be provided to the WAM on the day of completion.

8.1.6 Protocols will be provided to the Contractor by the EPA Work Assignment Manager prior to initiation of the technical work.

8.1.7 The Contractor shall maintain a sample custody log of PM, DNPH, water impingers, passivated canisters, fuels, and bags submitted for sampling and/or received for analysis following sample collection. In the majority of cases, it may be necessary for a number of individual samples from a single source to be

composited, thereby necessitating careful recording of the composited samples. The WAM will also notify the Contractor of the analytical method they plan to apply prior to analyzing any sample set.

8.1.8 The Contractor shall provide for appropriate handling and disposal of all laboratory waste materials, including expired test fuels.

8.1.9 The Contractor shall operate, maintain, modify, and calibrate analytical instrumentation and ancillary equipment in the EPA Mobile Source Emissions Measurement and Characterization Lab. The Contractor shall maintain a file of operating manuals for all equipment and instruments.

8.1.10 The Contractor shall maintain a complete and up-to-date inventory for the MSEMC lab along with Material Safety Data Sheets for all chemicals and gases.

8.1.11The Contractor shall supply to the WAM on a monthly basis a written progress report that includes: (1) a list by run number of the dynamometer tests completed; (2) a list by identification number of the samples provided for analysis; (3) description of experimental procedure used and any observed anomalous behavior; (4) list of calibrations completed with the date of each instruments calibration respectively, and (5) a general description of laboratory operations. The Contractor shall also provide to the WAM electronic copies of raw data sets.

8.1.12Labor mix: To achieve the objectives of the WA the following labor mix is required:

A person with extensive (seven or more years) experience in operation of a dynamometer analysis bench. This technician must have expertise in the area of wiring, plumbing, and trouble-shooting an analytical instrument bench. This requires a fundamental understanding of the principles of chemiluminescent detection, non-dispersive infrared detection, non-dispersive ultraviolet detection, and flame ionization detection. The technician must be able to perform instrument calibrations, understand the principles behind these processes to properly assess corrective actions in the likely event of anomalous phenomena in the course of instrument calibrations. The technician is generally the first person to identify instrument malfunctions and bring this to the attention of the senior dynamometer technician. The technician must be familiar with the operational software for the dynamometer. The technician must understand and comply with the operational specifications for chassis dynamometers contained in the CFR. The technician must have experience in and knowledge of automotive systems, research fuels handling, and basic refrigeration.

The technician must be strong enough to move heavy equipment (in accordance with OSHA regulations). The technician assists the EPA's senior dynamometer technician in all technical functions. The technician will help prepare sample media and operate sampling equipment to collect mobile source samples. He will

occasionally maintain the laboratory instrumentation, clean glassware and other laboratory consumables as required by quality assurance log samples as appropriate and other especially routine tasks. This individual shall pay special attention to detail as it relates to logging samples and recording substrate weights.

8.1.13Provision of Spares, Parts, Equipment, and Instruments

These parts, components, equipment, and instruments must be directly applicable to the function of the light-duty, heavy-duty, small engine, or portable dynamometers and their sample systems.

a. The Contractor shall provide adequate spares, parts, equipment, and instruments to perform the weekly dynamometer emissions tests.

b. Spares, parts, equipment, and instruments will include but are not limited to those listed in Attachment 2. Quantities will be held at the specified levels in Attachment 2.

WA SPECIFIC EQUIPMENT

The Contractor shall be required to provide three test vehicles as specified in Task 4 above.

QUALITY ASSURANCE

The Contractor shall update the MSEMC Quality Assurance Project Plan (QAPP) following the guidance in Attachment #1 to this performance work statement. The contractor shall collect and record vehicle information as described in the MSEMC QAPP.

DELIVERABLES

The contractor shall supply a project work plan and an Infrastructure Support Allocation Report summarizing LOE and ODC associated with completion of Task 8 only.

SCHEDULE of DELIVERABLES

Steps	Completion Date
Project work plan submission	Within 20 calendar days of receipt of WA
Emissions Testing Start	April 1, 2016
Emissions Testing Complete	August 1, 2016
Infrastructure Support Allocation Report	September 30, 2016

ATTACHMENT #1 TO THE STATEMENT OF WORK

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS: Include cover page, distribution list, approvals, and page numbers.

1. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

2. PROJECT DESCRIPTION AND OBJECTIVES

2.1 Describe the process and/or environmental system to be evaluated.
2.2 State the purpose of the project and list specific project objective(s).

3. ORGANIZATION AND RESPONSIBILITIES

3.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
3.2 Include a project schedule that includes key milestones.

4. SCIENTIFIC APPROACH

4.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
4.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
4.3 Describe the general approach and the test conditions for each experimental phase.

5. SAMPLING PROCEDURES

5.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.

5.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.

5.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.

5.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.

5.5 Describe the method for uniquely numbering each sample.

5.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

6. MEASUREMENT PROCEDURES

5.1. Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.

5.2. If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

7. QUALITY METRICS (QA/QC CHECKS)

6.1. For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

6.2. Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

8. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

8.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

8.2 Describe data validation procedures used to ensure the reporting of accurate project data.

8.3 Describe how the data will be summarized or analyzed (e.g., qualitative

analysis, descriptive or inferential statistics) to meet the project objective(s).

8.3.1 If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

8.3.2 If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

8.4 Describe data storage requirements for both hard copy and electronic data.

9. REPORTING

9.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

9.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

10. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-034

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2018 Base Option Period Number 1	MSEMC

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:
The purpose of this amendment is to revise task 8 of the PWS. A technical memo and revised cost estimate are requested within 7 business days.

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2018 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Thomas Long (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3944 FAX Number:	
Project Officer Name Robin S. Harris (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-0955 FAX Number:	
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:	
Contracting Official Name Mark Cranley (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109	

Performance Statement of Work Modification

WA Title: Mobile Source Emissions Measurement and Characterization

WA #: 1-034 WACOR: Thomas Long

Contract #: EP-C-15-008 Alternate WACOR: Richard Baldauf

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

Amendment

Total cost of LOE to complete Task 8 shall not exceed <u>3624 hours</u>.

SUMMARY OF OBJECTIVES

Generate emissions data from three vehicles satisfying Office of Transportation and Air Quality requirements for new Motor Vehicle Emission Simulator (MOVES), TBD. Chassis dynamometer driving cycles will consist of one Federal Test Protocol (http://www.epa.gov/otaq/emisslab/methods/huddscol.txt) and three repetitions of a locally developed cycle which is approximately 20 minutes in duration. These driving cycles will be repeated until nine valid (see below) data sets are created. On road measurements with a PEMS unit will be made over the road. Each set of routes is expected to be completed in one working day. A set of three routes is to be repeated by all three vehicles four times.

BACKGROUND

This project directly addresses the air, climate, and human health program areas, and supports other motor vehicle projects. While the two currently regulated "critical pollutants", particulate matter (0.01 grams per brake-horsepower-hour (g/bhp-hr)) and NOx (0.20 g/bhp-hr) impact air quality and related health issues, proposed new rules focus on two related areas with broader environmental and social effects: vehicle fuel economy and greenhouse gas (GHG) emissions. The two go hand-in-hand because burning carbon-based petroleum fuels creates carbon emissions, so improving fuel economy directly lowers an internal combustion engine's main GHG, carbon dioxide (CO2).

New vehicle rules are being phased in between 2014 and 2018 as part of an overall energy strategy that looks to reduce U.S. dependency on foreign energy supplies and lower CO2 creation to address global warming concerns.

It is estimated that commercial trucks consume more than 2-million barrels of oil every day and account for 20% of transportation-related GHGs. For example, the state of California estimates that diesel trucks are responsible for seven and a half percent of all of California's global warming pollution.

The call for truck rules does not come with specific target numbers, but requires EPA, with the aid of the National Highway Transportation Safety Administration (NHTSA) to set standards based on research data. Much of the guidance for determining the standards will come from a congressionally mandated report. Created under the auspices of the National Research Council (NRC), "Technologies and Approaches Reducing the Fuel Consumption of Medium- and Heavy-Duty Vehicles" was put together by a 19-member panel that combined academic researchers, engineers, and technologists with backgrounds in truck and component manufacturing.

Given the size of the existing database for emissions from either Medium Heavy-Duty Trucks (MHDT) or gas direct injection (GDI) vehicles, this study hopes to provide insight into whether it is necessary to modify MOVES to improve these emission factors or to fill similar gaps in represented emission factors.

SCOPE

This Work Assignment (WA) has been designed to fill data gaps or improve existing emission factors for the use case of MHDT or GDI (or similar missing emission factors to be specified by OTAQ).

- Testing will be conducted on either three MHDT or three GDI vehicles. MHDT vehicles will be tested under both laden, 90% Gross Vehicle Combined Weight Rating (GCWR) and unladen (50% GVWR) conditions. GDI vehicles will be tested at ambient temperatures of 72 °F (22 °C) and 20 °F (-7 °C).

- On road routes are local. Two of the routes are in Chapel Hill and one is in Hillsborough. Considerations included a protracted grade and varying traffic conditions in each of the speed ranges 0 to 25 mph, 25 to 50 mph, and above 50 mph. Due to fueling and travel considerations, all routes must be completed in a 5 hour time frame, including one half hour for the drivers to eat lunch.

- Chassis dynamometer test cycles will include a cold start FTP followed by three warm start Mobile Source Distributed Power Driving Schedules designed to generate data in each of the operating modes represented in the MOVES model.

- Core dynamometer bench measurements will include Total hydrocarbon (THC), non-methane hydrocarbons (NMHC), non-methane organic gas (NMOG),

oxides of nitrogen (NOx), nitrogen dioxide (NO2), carbon monoxide (CO), carbon dioxide (CO2) and particulate matter (PM)

- Core portable emissions measurement system (PEMS) measurements will include Total hydrocarbon (THC), nitrogen oxide (NO), oxides of nitrogen (NOx), nitrogen dioxide (NO2), carbon monoxide (CO), and carbon dioxide (CO2)

- Chassis dynamometer testing shall also generate speciated volatile organic compound (speciated VOC) data. VOC compounds

TECHNICAL APROACH/OBJECTIVES

Task 3 Test Fuels and Lubricants

The Contractor will be required to provide test fuel. Fuel will conform to the requirements stated in the each vehicle's operating manual and be procured from the distributor as a single batch. The Contractor will provide speciated analyses of the fuels sampled before and after project emissions testing and speciated analysis of the lubricant sampled after project emissions testing.

Task 4 Vehicle Procurement and Preparation

The Contractor shall be required to provide three test vehicles. Two will be driven on-road by Contractor personnel. The other one will be driven on-road by government personnel. All three will be driven on the chassis dynamometer by government personnel.

Each vehicle to be tested shall undergo a thorough inspection before beginning the test preparation sequence. This includes inspection and documentation of the engine, transmission, axles, exhaust system and tires, and documentation of the ECM status. Descriptively titled photographs of the vehicles' exhaust systems, engine plates, and emission plates shall be taken and included as part of the progress and final reports. The Contractor shall collect and record vehicle information as described in the Quality Assurance Project Plan (QAPP). Preparation will include assisting with the performance of on-road coastdowns.

Each vehicle shall then undergo initial crankcase oil, oil filter and air filter replacement. Oil and air filters shall be procured by the Contractor according to manufacturer's recommendations. Engine oil recommended in the owner's manual of each vehicle shall be used. The recommended grade of lubricant shall be purchased.

After the last test of each vehicle in the program, the Contractor shall record the lubricant level indicated on the dipstick before collecting a 0.25-quart oil sample for analysis.

If any of the vehicles are equipped with traction control, the Contractor shall ensure that the traction control is disabled either through an interior disable button or other method (remove power fuse to anti-lock brake system (ABS), and place a placard in the vehicle indicating the method of disabling traction control if driver input is required.. The Contractor will be provided target road load coefficients and set road load coefficients for the test vehicles according to 40 CFR 1066.301 and 40 CFR 1066.310 (or the Contractor may propose and use an alternate method, subject to approval by EPA). For the purpose of this study, the agreed road load setting shall remain the same for all testing on a given vehicle.

The Contractor shall provide hardware and software for reading and archiving vehicle engine control module (ECM) data during emissions testing.

Task 5 Vehicle Testing

5.1 Basic Testing Protocol

The basic dynamometer testing protocol begins with a cold start Federal Test Protocol (FTP), followed by three warm start Mobile Source Distributed Power Driving Schedules (MSDPDS). For GDI light-duty vehicles (LDV) this protocol will be conducted in compliance with CFR Part 86 Subpart C, CFR Part 1065, and CFR part 1066. For MHDT the HD-UDDS will be conducted in compliance with CFR Part 86 Subpart N, and CFR Part 1065. This test sequence will be repeated for each vehicle. For MHDT, this test sequence will be performed in both the laden and unladen conditions. For GDI LDVs, this test sequence will be performed at ambient temperatures of 72 °F (22 °C) and 20 °F (-7 °C). Each test condition will be run on each vehicle at least three times. A fourth test may be run if necessary as described in 5.1.1. MHDT tests will be performed on the 72-inch single roll electric heavy-duty chassis dynamometer. GDI LDV tests will be performed on the 48-inch single roll electric light-duty chassis dynamometer. The EPA will provide the same driver to be used for all tests on a given vehicle.

The gaseous emissions to be measured and reported are THC, CH4, NOx, NO2, CO, and CO2. The Contractor will use cleaned SUMMA cans (provided by the EPA) to

collect sample from which the US EPA will speciate the VOCs. The Contractor shall speciate the oxygenates. The Contractor will provide polyurethane foam (PUF) sorbent plugs and collect samples on which the US EPA will conduct PAH analyses. The Contractor will provide teflon filters for the EPA to perform metals analysis on the runs made on the chassis dynamometer. The Contractor will provide DNPH cartridges and collect samples on which the US EPA will conduct carbonyl analyses. The Contractor will provide teflon filters on which the the US EPA will collect samples and perform gravimetric analyses.

During all emission tests, the Contractor shall record the following ECM parameters at the rate of 1 Hz using Contractor-supplied data acquisition equipment:

- RPM
- Vehicle speed
- Engine load
- MIL status
- Absolute throttle position
- Engine coolant temperature
- Short term fuel trim-bank 2
- Long term fuel trim-bank 2
- Fuel/air commanded equivalence ratio
- Alcohol fuel percent
- Manifold absolute pressure
- Spark advance
- PID Control Module Voltage
- Air Flow Rate From Mass Air Flow Sensor

The facilities for testing shall be maintained in conformance with the requirements of 40 CFR Part 86 Subparts C and N and 40 CFR Part 1066 as they apply to vehicle emissions testing. THC, CH4, NOx, NO2, CO, and CO2 emissions sampling and measurement shall be conducted as specified in 40 CFR 1065. The minimum detection limit for NO2, measurements shall be 5 ppb. If some aspect of testing will need to be done in variance to the above specifications the Contractor shall

describe why that is the case and how it may impact the test results. Variances must be approved by the EPA WAM before testing may begin.

The Contractor shall verify that the tunnel flow remained constant during the test. The CVS blower shall be kept on for ½ hour before the first emission test on a given day and continuously between emission tests to ensure tunnel stability.

The Contractor shall provide defined and maintained cooling fan placement and flow for each test vehicle on all the tests. The flow of air sweeping the vehicle in the test cell shall be consistent between tests.

The Contractor shall perform "blank" UDDS tests at one month intervals during this program. These tests will involve running the full test sequence drawing only background air into the sampling system. All sampling systems will be operated and measurements will include:

- Phase level THC, CH4, CO, NOx, CO2, PM, NO2, VOCs (including alcohols and carbonyls)
- Continuous THC, CH4, CO, CO2 and NOx

The Contractor is not expected to provide a technician to support the three weeks of PEMS testing but the vehicle leases will need to span the duration from test preparation at the beginning of April 1, 2015 through the end of November 2016 to allow for the vehicles to be used for onroad testing by EPA personnel.

5.2 Speciation of Volatile Organic Compounds (VOCs), Dynamometer Tests

Sampling and analysis of alcohols shall be done using CARB method 1001, "Determination of Alcohols in Automotive Source Samples by Gas Chromatography" as modified by the MOP included in the QAPP. Sampling and analysis will be the responsibility of the Contractor.

Sampling and analysis of carbonyl compounds shall be done using TO-11a. Carbonyl sampling is to be performed by the Contractor. Carbonyl analysis will be performed by the EPA.

The Contractor shall seal and store alcohol samples at a temperature below 40oF immediately following collection. The Contractor shall make every effort to analyze these samples on the day they are collected, but no later than within six calendar days.

The Contractor shall provide segregated storage for alcohol and carbonyl samples to prevent their contamination.

No more than one vehicle shall be tested on the chassis dynamometer per test day, unless the Contractor can demonstrate that the total number of vehicles tested on that day and the timing of their tests will not compromise the time limit requirements imposed on sample analyses.

5.3 (Reserved)

5.4 PM measurement and Analysis

For tests on the chassis dynamometer, PM shall be collected on a Teflon filter and quartz filter for mass determination and subsequent chemical analysis. The sampling method shall allow for the collection of sufficient sample for chemical analyses. PM mass will be measured as specified in 40 CFR Part 1065. Two parallel filters will also be collect samples for each phase. Testing will be conducted collecting PM samples in parallel. One set of filters will be at the cerfication filter face velocity of 100 cm/s and the other will be set to alternate speeds as specified by OTAQ. Other deviations from this method will require approval from EPA.

Task 6 Coordination and Support of Non-regulated Emissions Measurements

6.1 UV-DOAS Instrument

(Reserved)

6.2 FTIR

Coordinate with Edgar Thompson as he conducts FTIR measurements from a probe into the dilution tunnel.

6.3 PAH

Coordinate with Michael Hays to provide sufficient media to sample PAH's for 3 of the five sample phases per test. This will include use of alternate absorbents to polyurethane foam (PUF).

6.4 VOC

Coordinate with Tom Long or designee to use sufficient clean and prepared SUMMA cans for VOC analysis for all five sample phases per test.

6.5 Metals

Coordinate with Michael Hays to provide sufficient media for metals analysis on two of the five sample phases per test.

Task 7 Deliverables

7.1 Work Plan

The Contractor shall submit a work plan for this Work Assignment.

7.2 Infrastructure Support Allocation Report

The Contractor shall provide an interim and final report detailing the resources from this work assignment apportioned to support of Task 8. Each report is not to exceed one page of narrative providing the amount of ODC and LOE expended to support Task 8 and a brief statement of what was accomplished.

7.3 (Reserved)

7.4 Monthly Reports

The Contractor shall provide monthly progress reports and invoices in accordance with contract. See the Reports of Work, EPAAR clause 1552.211-70, Submission of Invoices, EPAAR clause 1552.232-70.

Taske 8 Mobile Source Dynamometer Research Laboratory Infrastructure Support

(to be priced separately)

In fulfillment of the objective of this task, the following Subtasks shall be performed by the Contractor, and throughout the course of performing these Subtasks, the Contractor shall comply with the most recent Mobile Source Emissions Measurement and Characterization Quality Assurance Project Plan (QAPP) and the SOP for the dynamometer or PEMS to be used that week. **Total LOE to complete Task 8 shall not exceed 3624 hours.**

8.1.1 The Contractor shall prepare and operate the dynamometer, analytical bench, CVS sampling system and Portable Emissions Measurement Systems in accordance with the CFR and laboratory protocols established by the EPA. Variances are permitted only by technical direction and/or approval of the WAM.

8.1.2 The Contractor will perform instrument/equipment evaluations and repairs as necessary to demonstrate and maintain proper operability and will assist in facility/equipment problem resolution

8.1.3 The Contractor shall acquire supplies, consumables, and calibration/reference materials needed to assess regulated emissions, PM2.5, carbonyls, VOCs, SVOCs, MSATs, and oxygenates. Gas standards will be procured from Scott Specialty Gases or a vendor whose compliance with EPA standards has been shown to be statistically equivalent.

8.1.4 The Contractor shall forward the raw data to the WAM on the day the samples are taken.

8.1.5 Quality assurance forms provided by the WAM to the Contractor will be completed in accordance with WAM technical direction. An electronic copy (PDF) will be provided to the WAM on the day of completion.

8.1.6 Protocols will be provided to the Contractor by the EPA Work Assignment Manager prior to initiation of the technical work.

8.1.7 The Contractor shall maintain a sample custody log of PM, DNPH, water impingers, passivated canisters, fuels, and bags submitted for sampling and/or received for analysis following sample collection. In the majority of cases, it may be necessary for a number of individual samples from a single source to be

composited, thereby necessitating careful recording of the composited samples. The WAM will also notify the Contractor of the analytical method they plan to apply prior to analyzing any sample set.

8.1.8 The Contractor shall provide for appropriate handling and disposal of all laboratory waste materials, including expired test fuels.

8.1.9 The Contractor shall operate, maintain, modify, and calibrate analytical instrumentation and ancillary equipment in the EPA Mobile Source Emissions Measurement and Characterization Lab. The Contractor shall maintain a file of operating manuals for all equipment and instruments.

8.1.10 The Contractor shall maintain a complete and up-to-date inventory for the MSEMC lab along with Material Safety Data Sheets for all chemicals and gases.

8.1.11The Contractor shall supply to the WAM on a monthly basis a written progress report that includes: (1) a list by run number of the dynamometer tests completed; (2) a list by identification number of the samples provided for analysis; (3) description of experimental procedure used and any observed anomalous behavior; (4) list of calibrations completed with the date of each instruments calibration respectively, and (5) a general description of laboratory operations. The Contractor shall also provide to the WAM electronic copies of raw data sets.

8.1.12Labor mix: To achieve the objectives of the WA the following labor mix is required:

A person with extensive (seven or more years) experience in operation of a dynamometer analysis bench. This technician must have expertise in the area of wiring, plumbing, and trouble-shooting an analytical instrument bench. This requires a fundamental understanding of the principles of chemiluminescent detection, non-dispersive infrared detection, non-dispersive ultraviolet detection, and flame ionization detection. The technician must be able to perform instrument calibrations, understand the principles behind these processes to properly assess corrective actions in the likely event of anomalous phenomena in the course of instrument calibrations. The technician is generally the first person to identify instrument malfunctions and bring this to the attention of the senior dynamometer technician. The technician must be familiar with the operational software for the dynamometer. The technician must understand and comply with the operational specifications for chassis dynamometers contained in the CFR. The technician must have experience in and knowledge of automotive systems, research fuels handling, and basic refrigeration.

The technician must be strong enough to move heavy equipment (in accordance with OSHA regulations). The technician assists the EPA's senior dynamometer technician in all technical functions. The technician will help prepare sample media and operate sampling equipment to collect mobile source samples. He will

occasionally maintain the laboratory instrumentation, clean glassware and other laboratory consumables as required by quality assurance log samples as appropriate and other especially routine tasks. This individual shall pay special attention to detail as it relates to logging samples and recording substrate weights.

8.1.13 Provision of Spares, Parts, Equipment, and Instruments

These parts, components, equipment, and instruments must be directly applicable to the function of the light-duty, heavy-duty, small engine, or portable dynamometers and their sample systems.

a. The Contractor shall provide adequate spares, parts, equipment, and instruments to perform the weekly dynamometer emissions tests.

b. Spares, parts, equipment, and instruments will include but are not limited to those listed in Attachment 2. Quantities will be held **to the minimum levels** specified in Attachment 2. **In addition, the Contractor will provide sufficient parts and support labor to complete the PM box in the heavy-duty dynamometer to make them equivalent to the one in the light-duty dynamometer and comply with 40 CFR 1066. This is to include all necessary flow controller, pumps, and plumbing and electricals. The Contractor will repair or replace the main breaker for the dilution tunnel pump on the light-duty dynamometer. The Contractor will provide replacement continuous emission monitors (CEMS) for the light-duty dynamometer instrument. The Contractor will provide a critical flow orifice (CFO) kit to leak check the dilution tunnels in all of the labs when these modifications are complete. The CFO kit must be compatible with the software on the light-duty dynamometer bench.**

WA SPECIFIC EQUIPMENT

The Contractor shall be required to provide three test vehicles as specified in Task 4 above.

QUALITY ASSURANCE

The Contractor shall update the MSEMC Quality Assurance Project Plan (QAPP) following the guidance in Attachment #1 to this performance work statement. The contractor shall collect and record vehicle information as described in the MSEMC QAPP.

DELIVERABLES

The contractor shall supply a project work plan and an Infrastructure Support Allocation Report summarizing LOE and ODC associated with completion of Task 8 only.

SCHEDULE of DELIVERABLES

Steps	Completion Date
Project work plan submission	Within 20 calendar days of receipt of WA
Emissions Testing Start	April 1, 2016
Emissions Testing Complete	January 27, 2017
Infrastructure Support Allocation Interim Report	September 30, 2016
Infrastructure Support Allocation Report	March 31, 2017

ATTACHMENT #1 TO THE STATEMENT OF WORK

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS: Include cover page, distribution list, approvals, and page numbers.

1. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

2. PROJECT DESCRIPTION AND OBJECTIVES

2.1 Describe the process and/or environmental system to be evaluated.
2.2 State the purpose of the project and list specific project objective(s).

3. ORGANIZATION AND RESPONSIBILITIES

3.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
3.2 Include a project schedule that includes key milestones.

4. SCIENTIFIC APPROACH

4.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
4.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
4.3 Describe the general approach and the test conditions for each experimental phase.

5. SAMPLING PROCEDURES

5.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.

5.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.

5.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.

5.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.

5.5 Describe the method for uniquely numbering each sample.

5.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

6. MEASUREMENT PROCEDURES

5.1. Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.

5.2. If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

7. QUALITY METRICS (QA/QC CHECKS)

6.1. For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

6.2. Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

8. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

8.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

8.2 Describe data validation procedures used to ensure the reporting of accurate project data.

8.3 Describe how the data will be summarized or analyzed (e.g., qualitative

analysis, descriptive or inferential statistics) to meet the project objective(s).

8.3.1 If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

8.3.2 If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

8.4 Describe data storage requirements for both hard copy and electronic data.

9. REPORTING

9.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

9.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

10. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-036

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base X Option Period Number	

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Eben Thoma (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7969 FAX Number:	
Project Officer Name Robin Baily (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:	
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:	
Contracting Official Name Mark Cranley (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109	

Performance Statement of Work

WA Title: NEIC GMAP Upgrade

WA #: 1-36 WACOR: Eben Thoma

Contract #: EP-C-15-008 Alternate WACOR:

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of the award through March 31, 2017.

SUMMARY OF OBJECTIVES

This work assignment (WA) will upgrade the GMAP OTM 33 mobile measurement system owned by EPA OECA NEIC as specified in the task section. This WA continues efforts that stated in WA 0-36.

BACKGROUND

Reducing fugitive and area source emissions of greenhouse gases (GHGs), hazardous air pollutants (HAPs), other volatile organic compounds (VOCs), and certain inorganic gases from industrial facilities, agricultural operations, energy production, and waste disposal, is an ongoing priority for EPA and our state and local co-regulators. Unlike stack emissions, fugitive and area source releases are difficult to detect and measure, due to the spatial extent and inherent temporal variability of the potential sources.

Fugitive emissions detection and measurement using new technical approaches (e.g. infrared cameras, sensors, and mobile measurements) can augment manual leak detection and repair LDAR programs (where they exist) by providing spatially-resolved, speciated, and/or near real-time emissions information. The detection of fugitive emissions by time-resolved monitors, coupled with wind direction data, can be used to pinpoint and repair fugitive leaks with short response times, greatly decreasing emissions. Mobile measurements approaches are particularly useful to identify spatially distributed fugitive emissions and assisting in compliance activities.

As part of previous contracts, and with in-house EPA resources, several EPA mobile measurement systems (GMAP systems) have been developed since

2010. The most advanced system belongs to EPA NEIC and is stationed in Denver Colorado. This WA further develops and documents this system.

SCOPE

This WA will upgrade and document the OECA NEIC GMAP system as detailed below. Specific hardware and software upgrades will be executed and an SOP and trouble-shooting guide will be produced and reviewed by EPA ORD NRMRL QA and OECA NEIC. This WA continues efforts that stated in WA 0-36.

TECHNICAL APROACH/OBJECTIVES

Under the technical direction of the EPA work assignment manager (WAM) and in consultation with the EPA NEIC technical lead, the contractor shall execute the tasks listed below. The contractor shall assume bi-weekly meetings and conference calls to review progress with the WAM and NEIC technical lead related to these efforts. Meeting frequency in the planning phases of the projects shall be greater. The contractor shall evaluate the potential need for outside consultants and/or laboratories with expertise in the various technical areas to meet deliverables and shall be responsible for defining, executing, and managing any subcontracts that may be required. The contractor shall be responsible for arranging and executing any required equipment purchases or shop work necessary to complete task.

Note: Some of the below tasks were started in WA 0-36 and some tasks maybe compete before the initiation of the option period 1 (WA 1-36).

Task 1: Upgrade and documentation of NEIC GMAP OTM 33 mobile measurement system.

Task 1.1: Based on information provided by the WAM and NEIC Technical lead, the contractor shall review the current system design and software of the EPA NEIC GMAP OTM 33 system to facilitate technical discussions.

Task 1.2: Under the technical direction of the WAM and in consultation with the EPA NEIC technical lead, the contractor shall develop a function specification for software changes and engineering support plan for

hardware changes the NEIC GMAP upgrade. This shall include the plan to develop the documentation for the upgraded system. The contractor shall assume that the NEIC OTM 33 vehicle will remain in Denver and that the some implementation elements will be executed remotely by the EPA NEIC technical lead. In some cases, equipment may be shipped back and forth from Denver to RTP for reconfiguration.

To aid in contractor WA cost estimate development, some elements of the upgrade are listed below. The elements are subject to change based on technical discussions and design review.

Example Hardware changes:

- The existing cellular modem shall be removed and replaced with upgraded capability for data transmission to home base.
- The WiFi camera shall be reconfigured so that it connects with CAT5 cable
- The router shall be reconfigured to disable WiFi and antenna removed
- The laptop shall connect to the network with CAT5 cable
- A new external hard drive will be ordered
- A new ruggedized laptop shall to support field operation of the system shall be ordered and configured to Agency standards. The solid state hard drive will be encrypted and a new cellular Internet card would be purchased. Detailed specifications below:
  - Specifications for ruggedized laptop:
  - Intel Core i7-2620M, 2.7GHz, 3MB Cache or Better
  - Minimum 14" monitor
  - Internal 8x DVD+/- RW
  - 512MB Onboard Video Card
  - Memory - 6GB DDR3 / Expandable to 8GB DDR
  - 250GB SSD
  - Gigabit Ethernet
  - Integrated smart card reader
  - Integrated cellular Internet card

- A new rackmount computer shall be ordered to replace the existing rackmount unit. The new computer will run Windows 7 (same

as the existing computer) and will be configured to Agency standards including hard drive encryption. Detailed specifications below:

- 1U rack mount mountable
- Able to operate at 40C sustained ambient temperatures
- Minimum 6 USB ports (2 front, 4 rear)
- Ethernet port
- PCI express x16 slot (to accommodate com port expansion card, full height, half length)
- DVD +/- RW drive
- Minimum 4GB RAM
- Solid State Hard drive, minimum 256 GB
- Intel i3 4th generation processor or better

Example Software changes:

A function specification shall be developed that will document software changes for the custom LabView MEMS software in the NEIC GMAP system. Some example changes are:

- Upgrading remote data view capability (from home base)
- Fix graph freezing issue
- Change bar graph on GUI to a graph of all compounds (selectable) during all operating modes except stationary measurement (bar graph must remain in this mode) either by changing the interface screen for selected modes or providing a different version of the software
- Provide a tab with a graph that presents only the gps and concentration plot without google earth image
- Provide a selectable forced scale for google earth concentration plots
- Provide a selection for either highest value or average value on google earth plots
- Provide wind direction and speed data on google earth plots using aio and gps data, selectable for one indicator of average speed and direction for run or as arrows (average for each data block) for each data block on graph. Speed scale should be selectable for specified fixed scale or autoscale
- Automate saving of Duvas raw data files using supplied file folder and filename storage conventions

- Automate saving to external hard drive simultaneously with saving to control computer hard drive using supplied file folder and filename storage conventions
- Automate saving to external hard drive simultaneously with saving to control computer hard drive using supplied file folder and filename storage conventions
- Possible integration of simplified OTM 33A emision rate analysis software as a separate routing (To be determined).

The contractor shall the contractor shall deliver the upgrade plan, including costing, (consisting of the function specification for software changes and engineering support plan for hardware changes) to the EPA WAM and NEIC Technical Lead for review and approval.

Task 1.3: Upon receipt of technical direction (approval of upgrade plan), the contractor execute the upgrade.

Task 1.4: The contractor shall ensure that the engineering changes and software revisions are documented and shall prepare a Standard Operating Procedure (SOP) and troubleshooting Guide for the updated EPA NEIC GMAP OTM 33 System.

QUALITY ASSURANCE

The need for development of a quality assurance project plan is not anticipated for Task 1 since no environmental data will be collected. The Standard Operating Procedure (SOP) and troubleshooting Guide shall be reviewed and approved by NRMRL and NEIC.

As general guidance for this contract:

Work involving collection of environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff. The Quality Assurance Project Plans (QAPPs) associated with these tasks shall be at a Category B level (unless otherwise specified) and must include all necessary elements as described in the referenced documentation (See Attachment 1).

All QAPPs and QAPP addendums shall be reviewed and approved by the contractor's WA leader and QA officer. Once it has obtained their approval, it shall be submitted to the EPA QA staff for review and approval. It shall be

accompanied by a signature page that is signed by the contractor's WA leader and QA officer to show that they have reviewed and approved the QAPP. It is the responsibility of the contractor's WA leader to document this process. Upon receipt of the signed QAPP, the EPA WA manager and QA manager will review and approve the QAPP and they will add their signatures to the signature page. For work involving analysis by outside laboratories, the contractor shall review and document all subcontractor quality management plan information as per current contract and EPA QA policy requirements.

DELIVERABLES

For all reporting deliverables, the contractor shall provide materials in Microsoft Word™ and Excel™ formats along with all raw and processed files if needed. The revised data acquis ion software shall be provided in LabVIEW compiled and native formats (to allow editing) with version control.

Task 1: All deliverables are due before March 31, 2017 unless otherwise noted

Task 1.1: The technical review shall be completed by May 30, 2017.

Task 1.2: The upgrade plan shall be delivered by June 30, 2017.

Task 1.3: The upgrade plan shall be executed (completed) within 60 days of approval of the upgrade plan.

Task 1.4: Documentation, SOP, and troubleshooting guide shall be delivered by January 15, 2017.

SCHEDULE of DELIVERABLES

See DELIVERABLES section for a Deliverable due dates.

All deliverables are due before March 31, 2017 unless otherwise noted

ATTACHMENT #1
TO THE STATEMENT OF WORK (SOW)

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD:

☐ **NRMRL=s Quality System Specifications:**

(1) a description of the organization=s Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization=s general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

☐ **NRMRL=s Quality System Specifications:**

(1) a description of the organization=s Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization=s general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

☐ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X **QAPP Requirements for Measurement Projects**

X **QAPP Requirements for Secondary Data Projects**

☐ **QAPP Requirements for Research Model Development and Application Projects**

☐ **QAPP Requirements for Software Development Projects**

X **QAPP Requirements for Method Development Projects**

☐ **QAPP Requirements for Design, Construction, and Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS: Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.
4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.
4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.
4.5 Describe the method for uniquely numbering each sample.
4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5. MEASUREMENT PROCEDURES

5.1. Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.

5.2. If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6. QUALITY METRICS (QA/QC CHECKS)

6.1. For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

6.2. Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

7.2 Describe data validation procedures used to ensure the reporting of accurate project data.

7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).

7.3.1 If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

7.3.2 If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

7.4 Describe data storage requirements for both hard copy and electronic data.

8. REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-037

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Eben Thoma	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-7969
			FAX Number:
Project Officer Name Robin Baily	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-7906
			FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code:
			Phone Number:
			FAX Number:
Contracting Official Name Mark Cranley	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-487-2351
			FAX Number: 513-487-2109

Performance Statement of Work

WA Title: R8 Well Pad Studies

WA #: 1-37 WACOR: Eben Thoma

Contract #: EP-C-15-008 Alternate WACOR:

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of the award through March 31, 2017.

SUMMARY OF WA OBJECTIVES

The primary objective of this work assignment (WA) is to improve activity data and emission information on pneumatic controllers (PCs) used on oil and natural gas (ONG) well pads located in the Uinta Basin. A secondary objective is to improve standardized measurement methods for PCs. A tertiary objective is to investigate research measurement methods of PCs. These objectives shall be achieved by preparing for, executing, and reporting on data gathering activities and a field study conducted in 2016. The contractor shall coordinate with an overall effort led by the EPA team that has additional outreach and training objectives. The specific contractor sub-objectives for this WA with deliverables and timing are detailed in subsequent sections.

BACKGROUND

As part of the field study scoping task of EP-C-15-008 WA 0-21, background information on this project was provided to the contractor, technical meetings were conducted, and some project preparation work was accomplished. In brief, this WA shall improve information on activity factors (e.g. numbers, types, applications), emission factors, and operational conditions of well pad PCs in the Uinta Basin by data gathering and field measurement activities in 2016. Data shall be analyzed, and a short-form report shall be generated. Reference project communication document "2016 Uinta Basin Pneumatic Controller Study Protocol Brief", provided references, and evacuated canister analysis procedures [ASTM C1-C3 and speciated non methane organic compound (SNMOC) analysis] for further background information.

SCOPE

The scope of this WA includes:

- Preparation of an itemized work plan (WP) and standard monthly progress updates and invoicing.

- Participation in regular coordination meetings with the WAM and project collaborators to review progress and coordinate efforts.

- Preparation for and execution of a 24 field-day measurement study of well pad PC emissions Uinta Basin in August/September 2016. The 24 field-day study does not include set up days, travel days, and weekends where work may not be performed. The contractor shall assume the availability of a Government furnished field vehicle to transport equipment and supplies to and from RTP and Utah and for use in the field to execute testing. The contractor shall assume the need to perform measurements in multiple geographically dispersed locations in the state of Utah for the field measurement study.

- Completion of (and ORD QA approval of) standard operating procedures and a quality assurance project plan for the field measurement study. The scope of the QAPP shall include secondary data gathering by project collaborators.

- Planning for implementation of multiple measurement approaches described subsequently. Since the contractor may not have the required technical experience and/or prototype equipment to execute some of the measurement approaches, the contractor shall evaluate the need for outside consultants and/or laboratories and/or equipment rentals to meet deliverables.

- Execution of pre-deployment testing of the developed approaches.

- Defining, executing, and managing any subcontracts and/ or equipment rentals that may be required.

- Defining, executing, and managing any site access agreements, and related infrastructure needs that may be required.

- Defining, executing, and managing all site safety plans and procedures for contractors and subcontractors in cooperation with site operators and/or ONG companies.

- Delivery of short form reports and data packages summarizing all data gathering activities.

The contractor shall be responsible for coordinating with the identified site operators and/or oil and natural gas (ONG) companies regarding on-site work performed by the contractor (or potential subcontractors). The contractor shall prepare site-specific safety plans meeting the requirements of the site operators and/or ONG companies. The contractor shall receive and document approval for the site safety plan prior to on-site work.

No confidential business information shall be discussed or recorded as part of any information gathering activity as part of this project. Any digital photographs or OGI videos documenting PC configurations shall be authorized by the cooperating site operator and/or ONG company.

The contractor shall coordinate with the EPA team for this project. The EPA team seeks to achieve other outreach and training objectives. The EPA team and other collaborators may observe some activities and may independently execute the developed protocols. The EPA team and other potential collaborators will be responsible for their own site safety plans and procedures in coordination with the site operators.

TECHNICAL APROACH/OBJECTIVES

The primary objective of this work assignment (WA) is to improve activity data and emission information on pneumatic controllers (PCs) used on upstream oil and gas well pads located in the Uinta Basin. A secondary objective is to improve standardized measurement methods. A tertiary objective is to investigate research measurement methods. These objectives shall be achieved by preparing for, executing, and reporting on data gathering activities and a field study conducted in 2016. The contractor shall coordinate with an overall effort led by the EPA team that has additional outreach and training objectives. The contractor sub-objectives for this WA are as follows with details in subsequent sections.

- Under the technical direction of the WAM, the contractor shall successfully coordinate with the EPA team, site operators, and other project collaborators to plan and execute the defined project elements.
- With requisite technical input, the contractor shall design an optimal approach for data gathering activities and field measurements to meet WA objectives.

- With input from EPA and technical experts, the contractor shall complete and obtain EPA ORD approval for all standard operating procedures (SOPs) and a quality assurance project plan (QAPP) for the data gathering, field measurements, and analyses.
- The contractor shall successfully conduct required pre-deployment testing to ensure adequate preparation for the field measurement study and provide results to the WAM.
- The contractor shall successfully and safety conduct the field measurement test and analyses and provide data deliverables.

QUALITY ASSURANCE

Work involving collection of environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff. The Quality Assurance Project Plans (QAPPs) associated with these tasks shall be at a Category B (unless otherwise specified) and must include all necessary elements as described in the referenced documentation (See Attachment 1).

All QAPPs and QAPP addendums shall be reviewed and approved by the contractor's WA leader and QA officer. Once it has obtained their approval, it shall be submitted to the EPA QA staff for review and approval. It shall be accompanied by a signature page that is signed by the contractor's WA leader and QA officer to show that they have reviewed and approved the QAPP. It is the responsibility of the contractor's WA leader to document this process. Upon receipt of the signed QAPP, the EPA WA manager and QA manager will review and approve the QAPP and they will add their signatures to the signature page. For work involving analysis by outside laboratories, the contractor shall review and document all subcontractor quality management plan information as per current contract and EPA QA policy requirements.

DELIVERABLES

For all data analysis and reporting deliverables, the contractor shall provide materials in Microsoft Word™ and Excel™ formats along with all raw and processed files or videos in native formats unless otherwise specified.

All deliverables are due before March 31, 2017 unless otherwise noted.

<u>Task 1: Preparation of Work Plan, Monthly Reports, and Invoices:</u>

Using information obtained in the planning activities conducted during the previous option period, the contractor shall prepare a work plan (WP) that

includes individual itemized cost and LOE estimates for each task set and each other direct cost (ODC) component (e.g. subcontract, travel, laboratory analysis, equipment rental, etc.), along with delivery dates. The contractor shall track expenditures for each task and ODC item individually and provide updates in standard monthly reports and invoicing.

Deliverable Date: WP due by April 29, 2016, others monthly

Task 2: QAPP and SOPs:

The contractor shall complete the development of the QAPP and SOPs (described subsequently) for the field measurement study. The scope of the QAPP shall include secondary data gathering by project collaborators. All SOPs shall be included in the QAPP. If during pre-deployment testing a project element is deemed unfeasible, the WAM shall issue written technical direction and the contractor shall suspend development of the SOP and remove it from QAPP for the field measurement test.

The contractor shall develop SOPs for on-site activities that include deployment and operation, calibration, QA procedures, and data archiving. The SOPs shall include operational checklists and data and sampling chain of custody procedures as appropriate. The SOPs shall be "stand alone" so they can be executed separately from the project specific QAPP.

SOPs and the QAPP for on-site measurements/analysis shall include:

1.0 PC Data Gathering SOP
2.0 PC OGI Observation SOP
3.0 PC Emission Measurements SOPs
    3.1 Modified High Volume Sampler (MHVS) use [assume two types of MHVS with separate SOPs]
    3.2 MHVS data analysis [two types]
    3.3 MHVS exhaust secondary quality assurance checks
    3.4 MHVS exhaust canister acquisition procedure
    3.5 MHVS exhaust canister analysis procedure
    3.6 Special research instrument MHVS exhaust sampling use and data analysis procedures
    3.7 Quantitative OGI use and data analysis procedure
4.0 QAPP for field measurement study

Deliverable Dates: Task 2 deliverable 1.0, 2.0, 3.0 due by May 27, 2016; deliverable 4.0 by July 1, 2016

Task 3: Pre-deployment testing:

The contractor shall execute pre-deployment testing of techniques and procedures and provide data to the WAM.

Deliverable Dates: All pre-deployment testing complete by July 29, 2016

Task 4: Safety Plans, Other Agreements/planning

The contractor shall be responsible for coordinating with the identified site operators and/or oil and natural gas (ONG) companies regarding on-site work performed by the contractor (or potential subcontractors). The contractor shall prepare site-specific safety plans meeting the requirements of the site operators and/or ONG companies. The contractor shall receive and document approval for the site safety plan prior to on-site work. Company-specific procedures (e.g. site safety screening, hot work permits, etc.) and personal protective equipment (e.g. required flame resistant clothing, work boots, safety glasses, 4-gas meter, etc.) shall be followed as per the site safety plan. Since digital and OGI cameras (and potentially other equipment) are not intrinsically safe devices (possible ignition sources), strict safety precautions shall be used in close coordination with the site operators and/or ONG companies and only after documented approval. The contractor shall be responsible for ensuring safe and compliant operation of any on-site subcontractors. The contractor shall initiate and execute any required subcontracts, equipment rentals, or other arrangements needed to execute the studies. The contractor shall develop deployment/shipping plan compatible with Department of Transportation procedures for transporting calibration gas cylinders and other materials.

Deliverable Dates: Task 4 activities complete with documentation provided to the WAM by July 29, 2016

Task 5: Execution of Field Measurement Test:

The contractor shall execute the field measurement test as per the approved QAPP (and in accordance with other agreements/procedures and safety plans).

Deliverable Dates: Task 5 completed by September 30, 2016

Task 6: Data and Laboratory analysis and reporting:

The contactor shall execute all laboratory and data analysis activities associated with the field study as per the QAPP and deliver a complete data package and short-form report describing QA findings.

Deliverable Dates: Task 6 completed by December 16, 2016

SCHEDULE of DELIVERABLES

The schedule of deliverables is included in the previous section. All deliverables are due before March 31, 2017 unless otherwise noted.

ATTACHMENT #1
TO THE STATEMENT OF WORK (SOW)

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD:

☐ **NRMRL=s Quality System Specifications:**

(1) a description of the organization=s Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization=s general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

☐ **NRMRL=s Quality System Specifications:**

(1) a description of the organization=s Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization=s general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

☐ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

X **QAPP Requirements for Measurement Projects**

X **QAPP Requirements for Secondary Data Projects**

☐ **QAPP Requirements for Research Model Development and Application Projects**

☐ **QAPP Requirements for Software Development Projects**

X **QAPP Requirements for Method Development Projects**

☐ **QAPP Requirements for Design, Construction, and Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/
EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS: Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.
1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
3.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
3.3 Describe the general approach and the test conditions for each experimental phase.

4. SAMPLING PROCEDURES

4.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.
4.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.
4.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.

4.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.

4.5 Describe the method for uniquely numbering each sample.

4.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

5. MEASUREMENT PROCEDURES

5.1. Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.

5.2. If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

6. QUALITY METRICS (QA/QC CHECKS)

6.1. For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

6.2. Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

7. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

7.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

7.2 Describe data validation procedures used to ensure the reporting of accurate project data.

7.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).

7.3.1 If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

7.3.2 If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

7.4 Describe data storage requirements for both hard copy and electronic data.

8. REPORTING

8.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

8.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

9. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-037

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Eben Thoma	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-7969
			FAX Number:
Project Officer Name Robin Baily	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-7906
			FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code:
			Phone Number:
			FAX Number:
Contracting Official Name Mark Cranley	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-487-2351
			FAX Number: 513-487-2109

WA 1-37 "R8 Well Pad Studies" Amendment 1:

The contractor shall refer to the original work assignment (WA) SOW and approved work plan (WP) for a discussion of project background and technical objectives.

This WA amendment addresses three (3) changes to the tasks in the approved WP. The need for these changes are a result of project planning and technical discoveries in the initial phases of the WA. Project managment information regarding the potential requirements for site access with industry collaborators has improved. Technical information regarding the necessary equipment and scientific approaches required to meet project objectives has improved. Additionally, some delays in project execution beyond of the control of the contractor have occurred necessitating adjustments to deliverable dates.

(1) The original WA SOW and approved WP (page 3) currently states: "No confidential business information will be discussed or recorded as part of any information gathering activity as part of this project". Based on discussions with potentially participating oil and gas companies and other EPA departments, it may be necessary to form memorandums of understanding (MOUs) between the companies and EPA ORD that could include site access and confidential business information (CBI) control clauses. The contractor shall therefore prepare for the potential for CBI control as part of this WA.

(2) Changes to Task 2: In the preparation phases of the project, several technical discoveries were made regarding the necessary equipment and scientific approaches required to meet project objectives. These discoveries necessitate changes to the field measurement plan and are detailed in the document provided to the contractor "QAPP Uinta Pneumatic Controller Study Discussion Draft_ 062916.docx". The contactor shall replace the list of standard operating procedures (SOPs) outlined in the WP under Task 2 with the produces outlined in the Draft QAPP and summarized below. This change to Task 2 also relaxes the requirement on production of "fully stand alone" SOPs. The contractor shall note that the developed SOPs do not need to be "fully stand alone" and are supported by, and developed in the context of the overall quality assurance project plan (QAPP). The contactor shall be responsible for development of the full QAPP based on EPA-provided drafts including the below appendices.

Appendix A: Overview of Site Safety Procedures and Documentation
Appendix B: Field Meteorological Measurement Procedures
Appendix C: PC and Site Information Gathering Procedures
Appendix D: PC Operational Assessment and Classification Procedures
Appendix E: Optical Gas Imaging Procedures
Appendix F: PC Actuation Counting Procedures
Appendix G: Operating Procedures for Flow Meter Measurements
Appendix H: Operating Procedures for Augmented BHFS Measurements
Appendix I: Evacuated Canister Acquisition and Analysis Procedures
Appendix J: Research Methods Field Procedures
Appendix K: Daily Data Backup Procedures
Appendix L: Primary Data Analysis Procedures and Summaries

Revised deliverable for Task 2: The full QAPP with appendices shall be delivered to EPA NRMRL QA Review by July 29, 2016.

(3) Changes to Task 3: The contractor shall perform pre-deployment testing based on the new procedures and using the new equipment outlined in the revised QAPP. The contractor shall develop and demonstrate daily in-field quality assurance tests, and the equipment necessary to execute these tests, as per the revised QAPP.

Revised deliverable for Task 3: Pre-Deployment test results will be submitted by August 26, 2016.

Th contractor shall prepare a revised WP and cost estimate based on these changes.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-037

☐ Other ☒ Amendment Number: 000002

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2016

Base Option Period Number: 1

Title of Work Assignment/SF Site Name:

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Eben Thoma (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7969 FAX Number:
Project Officer Name: Robin S. Harris (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-0955 FAX Number:
Other Agency Official Name: (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Mark Cranley (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

WA 1-37 "R8 Well Pad Studies" Amendment 2 September 1, 2016:

The contractor shall refer to the original work assignment (WA) and Amendment 1 SOW and approved work plan (WP) for a discussion of project background and technical objectives.

This WA amendment modifies Tasks 4, 5, and 6 adds Task 7 to the WA.

Due to technical and site access reasons, the field study elements of this work assignment shall not be executed as on continuous field effort in the September, 2016 time frame, but instead shall be executed as a series of shorter term field study segments (approximately 1 week duration). These field study segments shall be conducted over time as sites access agreements with the various companies are completed. The first field study segment is currently scheduled for September 19 through September 23 (not including travel time). This scheduling change requires the deliverables for Tasks 4, 5, and 6, to be revised and may change the allocation of resources in the project (i.e. travel budgets) so a new costing and new work plan is required. The new work plan shall also reflect the addition of Task 7 to the WA.

The new deliverables for Tasks 4, 5, and 6 are:

Task 4: Safety Plans, Other Agreements/planning

Deliverable Dates: Task 4 elements to be completed at least two weeks prior to initiation of a filed study segment.

Task 5: Execution of Field Measurement Test:

Deliverable Dates: Task 5 (all individual field study segments) shall be completed by March 30, 2017

Task 6: Data and Laboratory Analysis and Reporting:

Deliverable Dates: Task 6 completed within 30 days of complete of each field study segment.

New task

Task 7:

Under the technical direction of the WAM, the contractor shall document the availability, development status, and performance potential of three research prototype systems for oil and gas well pad fugitive emissions and PC emission measurements. If feasible, the contractor shall acquire/lease, or develop prototype versions of the three technologies for preliminary testing. Prior to execution of the preliminary tests, the contractor shall appropriately document the quality assurance aspects of the feasibility test. The contractor shall test these systems and produce bassline quality assurance information on these systems at the EPA test range at RTP NC. These tests shall be conducted in coordination with other activities on this WA and on WA 1-21. The contractor shall review the results of prototype test, field deployment feasibility assessments, and development/acquisition cost information with the WAM. Based on WAM review decision and available funding, the contactor shall procure and/or develop one or more of the three candidate technologies for further testing and field deployment. The contractor shall document the systems selected for further evaluation field testing in a QAPP addendum to the QAPP developed in Task 2 and shall incorporate these research measurements into planed field studies under this work assignment. The three research technologies are:

(1) Next generation optical gas imaging
(2) Next generation high volume sampling leak measurements
(3) Upstream oil and gas next generation fenceline emissions detection/measurement technology

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-039

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Richard Baldauf
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-4386
FAX Number:

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Statement of Work

WA Title: CitySpace Sensor Network Project

WA #: 1-039 WACOR: Rich Baldauf

Contract #: EP-C-15-008 Alternate WACOR: Ron Williams

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

The key objectives of this work assignment are to:

1. Conduct planning activities in support of a 20-node sensor network to be deployed in Memphis, TN.
2. Fabricate and test performance of the sensor nodes.
3. Implement field study for a 6 month period.
4. Recover equipment from the field.

BACKGROUND

EPA Regions are interested in having more granular information on air quality for goals of addressing citizen concerns about nearby sources, supporting siting of regulatory monitoring stations, and increasing knowledge of spatiotemporal variation of air pollution and associated health effects. Until recently, the spatial resolution of air pollution measurements have been limited by the cost and logistics associated with traditional monitoring approaches. During recent years, there have been significant advances in air pollution sensor technology which could meet these air quality characterization needs. Specifically, sensors are now being developed that are much smaller and lower-cost than traditional ambient air monitoring systems, with promising data. Thus, these sensors can be deployed in much greater density than traditional air monitoring equipment and provide new insights into air pollution trends. In order to understand the feasibility of using these new technologies, three EPA Regions (R4, R6, R7) are collaborating with ORD to conduct a pilot study implementing particulate matter sensors at one city (Memphis, TN). The field study also expects to have local partnership of Shelby County Public Health Department, TN. In addition, the field study implementation is anticipated to have data management support from EPA Office of Land and Emergency Management (OLEM) who manage the VIPER wireless monitoring system (https://www.epaosc.org/site/site_profile.aspx?site_id=5033).

The Memphis, TN location was select based on several factors. For one, the location has completed and has an upcoming significant air toxics study, implemented by University of Memphis, with over 100 locations that have granted site permission in the past for air toxics monitors to be sited (https://www.shelbycountytn.gov/index.aspx?NID=2754). In addition, Region 4 reviewed the PM monitoring network in Memphis and hypothesized that supplemental monitoring may reveal greater spatiotemporal variability in PM.

SCOPE

The scope of this work assignment is to prepare for and conduct a field study involving the deployment of a 20-node sensor network in Memphis, TN. The contract shall be responsible for sensor node siting, constructing and testing sensor nodes, configuring data reporting to be compatible with the VIPER system, deployment of nodes for a 6-month sampling duration, and recovery of equipment after the field study is completed. These steps are described in detail, in the tasks below.

Field data collection described in the following tasks will be conducted as detailed in a Category IV QAPP, which will be provided to the contractor for concurrence. The contractor shall review each QAPP and ensure that it is within the scope of this SOW and that it is adequate for the implementation of this SOW. The contractor work assignment leader and QA officer shall provide written documentation to the WA COR as record that they have reviewed the QAPP and agree that it addresses the needs of this SOW and the requirements in Attachment #1, or the contractor shall respond in writing with suggested revisions to make the QAPP meet the requirements of this SOW and the requirements in Attachment #1. It is the responsibility of the contractor work assignment leader to document this process. Upon receipt of the concurrence, the EPA work assignment manager and QA manager will review and approve each QAPP and they will add their signatures to the signature page. Work involving environmental data collection will not commence without an approved QAPP.

TECHNICAL APROACH/OBJECTIVES

Task 1: Field study planning support

The contractor shall attend field study planning meetings, approximately 1 hour per week, with the WA COR and additional team members from ORD / Regions / Shelby County. The contractor shall be responsible for securing site permission to place 20 sensor nodes in the Memphis, TN area, with the sites to be selected by the WA COR. During a preliminary site visit, EPA determined that approximately 9 nodes shall be placed at existing or decommissioned Shelby County regulatory monitoring locations where site permission shall be easily obtained. As this project will have

community stakeholders who will provide input to EPA on node siting, the contractor shall provide a liaison in Memphis with past experience conducting environmental monitoring with community stakeholders to assist with node siting. This liaison will participate in planning calls and visit candidate sites to secure siting permission. The contractor shall conduct a site visit to develop familiarity with the sites and understand logistics for node deployment.

Deliverable 1.1. The contractor shall provide a summary of proposed sites within 90 days of the WA initiation, based upon the siting selection criteria that provided as technical direction from the WA COR. The summary shall include a map, table of information (latitude, longitude, site owner), and planned node configuration at each site (solar- or land-power requirements, method of securing in place).

Deliverable 1.2. The contractor shall provide documentation of site permission for the 20 node locations within 120 days of WA initiation.

Task 2: Construct and test sensor nodes

The contractor shall design a sensor node that include the following components: Optical particle counter sensor that can measure PM1, PM2.5, and PM10 simultaneously (e.g., Alphasense OPCN2), secondary gas or PM sensor to be determined by the WA COR, 2-dimensional wind, temperature, humidity, noise sensor, cellular modem, microprocessor, local memory storage, and power system. The materials cost for each node is anticipated to be approximately $3000. Approximately 25% of the nodes are anticipated to be powered by landpower, with the remaining nodes requiring solar power with battery back-up. The nodes shall be constructed to be weather- and tamper-proof, designed to minimize any bias in the wind sensor readings, and maintain a small footprint. After approval of the node design by the WA COR, the contractor shall construct 24 nodes (20 for deployment, 4 for repair/replacement purposes). EPA will provide 20 machine to machine cell service plans, however the contractor shall be responsible for obtaining cellular modems. The contractor shall review the VIPER documentation and develop the microprocessor code and a supporting supervisory computer to assemble node data and relay it to the VIPER database. The node data structure shall be self-identifying, including the longitude and latitude and clear identification of measurements. The VIPER database support is not anticipated to have any cost to the contractor. After construction, the contractor shall conduct quality checks that will be outlined in a QAPP to be written by the WACOR. The contractor shall conduct a preliminary test of the nodes operability, co-locating all units on the EPA-RTP campus and operating for a minimum of 72 hours. The contractor shall also develop a standard operating protocol for the nodes.

Deliverable 2.1. The contractor shall provide a draft node design to the WACOR within 60 days of the WA initiation.

Deliverable 2.2. The contractor shall provide a final node design to the WACOR, within 30 days of receipt of comments from the WACOR.

Deliverable 2.3. The contractor shall document the preliminary test through photos, summary of wireless data communication to VIPER, and all collected node data, to the WACOR within 150 days of the WA initiation.

Task 3: Implement field study

The contractor shall transport and conduct an initial collocation of all 20 sensor nodes at the NCore station in Memphis, TN, with previously obtained approval from Shelby County. The collocation of all nodes shall be conducted for a 72 hour period. After the collocation is complete, the contractor shall deploy the 20 sensor nodes at pre-selected locations in Memphis, TN and conduct on-site quality checks that will be outlined with the QAPP to be provided by the WA COR. After installation, the contractor shall provide a monthly download of the memory card for each node and transmit to the WA COR. The contractor shall provide for maintenance and repair of the nodes during the 6-month field study. At the conclusion of the field study, the contractor shall recover all equipment and restore the sites to their original condition.

Deliverable 3.1. The contractor shall document the collocation through photos and provide the collocation data set to the WACOR, within 30 days of the field study initiation.

Deliverable 3.2. The contractor shall provide documentation of each node installation through photos and a written summary of on-site quality checks, within 30 days of the field study initiation.

Deliverable 3.3. The contractor shall provide the monthly data files to the WA COR within 14 days of each data download.

WA SPECIFIC EQUIPMENT

Task 2 will require the procurement of components to build 24 sensor nodes, each anticipated to be a total of $3000 in cost. Each individual node is constructed of fairly low cost sensor components and ancillary equipment.

ATTACHMENT 1 TO THE STATEMENT OF WORK

NRMRL QAPP REQUIREMENTS FOR MEASUREMENT PROJECTS

GENERAL REQUIREMENTS: Include cover page, distribution list, approvals, and page numbers.

1. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

2. PROJECT DESCRIPTION AND OBJECTIVES

2.1 Describe the process and/or environmental system to be evaluated.
2.2 State the purpose of the project and list specific project objective(s).

3. ORGANIZATION AND RESPONSIBILITIES

3.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.
3.2 Include a project schedule that includes key milestones.

4. SCIENTIFIC APPROACH

4.1 Describe the sampling and/or experimental design that will be used to generate the data needed to evaluate the projective objective(s). A description of the design should include the types and numbers of samples (including QC and reserve samples), the design of the sampling network, sample locations and frequencies, and the rationale for the design.
4.2 Identify the process measurements (e.g., flow rate, temperature) and specific target analyte(s) for each sample type.
4.3 Describe the general approach and the test conditions for each experimental phase.

5. SAMPLING PROCEDURES

5.1 Describe any known site-specific factors that may affect sampling procedures as well as all site preparation (e.g., sampling device installation, sampling port modifications, achievement of steady-state) needed prior to sampling.

5.2 Describe or reference each sampling procedure (including a list of equipment needed and the calibration of this equipment as appropriate) to be used. Include procedures for homogenizing, compositing, or splitting of samples, as applicable.

5.3 Provide a list of sample containers, sample quantities to be collected, and the sample amount required for each analysis, including QC sample analysis.

5.4 Specify sample preservation requirements (e.g., refrigeration, acidification, etc.) and holding times.

5.5 Describe the method for uniquely numbering each sample.

5.6 Describe procedures for packing and shipping samples, including procedures to avoid cross-contamination, and provisions for maintaining chain-of-custody (e.g., custody seals and records), as applicable.

6. MEASUREMENT PROCEDURES

5.1. Describe in detail or reference each process measurement or analytical method to be used. If applicable, identify modifications to EPA-approved or similarly validated methods.

5.2. If not provided in Section 5.1 or the referenced method, include specific calibration procedures, including linearity checks and initial and continuing calibration checks.

7. QUALITY METRICS (QA/QC CHECKS)

6.1. For each process measurement and analytical method, identify the required QC checks (e.g., blanks, control samples, duplicates, matrix spikes, surrogates), the frequencies for performing these checks, associated acceptance criteria, and corrective actions to be performed if acceptance criteria are not met.

6.2. Any additional project-specific QA objectives (e.g., completeness, mass balance) shall be presented, including acceptance criteria.

8. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

8.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

8.2 Describe data validation procedures used to ensure the reporting of accurate project data.

8.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).

8.3.1 If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

8.3.2 If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

8.4 Describe data storage requirements for both hard copy and electronic data.

9. REPORTING

9.1 List and describe the deliverables expected from each project participant responsible for field and/or analytical activities.

9.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report).

10. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-039

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2016
Base Option Period Number 1

Title of Work Assignment/SF Site Name:

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:
The purpose of this amendment is to revise the PWS to add tasks and deliverables. An updated cost estimate and memo to update the work plan is due within 7 business days.

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Richard Baldauf	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-4386
			FAX Number:
Project Officer Name Robin Baily	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-7906
			FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code:
			Phone Number:
			FAX Number:
Contracting Official Name Mark Cranley	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-487-2351
			FAX Number: 513-487-2109

WA 1-039: CitySpace Sensor Network Project

WPS

Amendment-July 25-2016

1. Overview

U.S. Environmental Protection Agency (EPA) Regions are interested in having more granular information on air quality for goals of addressing citizen concerns about nearby sources, supporting siting of regulatory monitoring stations, and increasing knowledge of spatiotemporal variation of air pollution and associated health effects. Until recently, the spatial resolution of air-pollution measurements has been limited by the cost and logistics associated with traditional monitoring approaches. During recent years, there have been significant advances in air-pollution sensor technology which could meet these air-quality characterization needs. Specifically, sensors are now being developed that are much smaller and lower-cost than traditional ambient-air monitoring systems, with promising data. Thus, these sensors can be deployed in much greater density than traditional air-monitoring equipment and provide new insights into air pollution trends.

In order to understand the feasibility of using these new technologies, three EPA Regions (R4, R6, R7) are collaborating with the Office of Research and Development (ORD) to conduct a pilot study implementing particulate matter (PM) sensors at one city (Memphis, Tennessee). The field study also expects to have local partnership of Shelby County Public Health Department, Tennessee. In addition, the field study implementation is anticipated to have data management support from the EPA Office of Land and Emergency Management (OLEM) who manage the VIPER wireless monitoring system (https://www.epaosc.org/site/site_profile.aspx?site_id=5033). The Memphis location was selected based on several factors. For one, the location has completed and has an upcoming significant air toxics study, implemented by the University of Memphis, with over 100 locations that have granted site permission in the past for air toxics monitors to be sited (https://www.shelbycountytn.gov/index.aspx?NID=2754). In addition, Region 4 reviewed the PM monitoring network in Memphis and hypothesized that supplemental monitoring may reveal greater spatiotemporal variability in PM.

2. Technical Approach

The scope of this Work Assignment (WA) is to prepare for and conduct a field study involving the deployment of a 16-node sensor network in Memphis, Tennessee. Jacobs will be responsible for constructing and testing sensor nodes, configuring data reporting to be compatible with the VIPER system, deployment of nodes for a six-month sampling duration, and recovery of equipment after the field study is completed. These steps are described in detail in the tasks below. Field data collection described in the following tasks will be conducted as detailed in a Category IV/B Quality Assurance Project Plan (QAPP), which will be provided to the contractor for concurrence. Jacobs will review each QAPP and ensure that it is within the scope of this statement of work (SOW) and that it is adequate for the implementation of this SOW. The Jacobs WA Leader (WAL) and quality assurance (QA) officer will provide written documentation to the EPA Work Assignment Contracting Officer's Representative (WACOR) as a record that they have reviewed the QAPP and agree that it addresses the needs of this SOW and the requirements in Attachment #1, or Jacobs will respond in writing with suggested revisions to make the QAPP meet the requirements of this SOW and the requirements in Attachment #1. It is the responsibility of the WAL to document this process. Upon receipt of the concurrence, the EPA WACOR and QA manager will review and approve each QAPP and will add their signatures to the signature page. Work involving environmental data collection will not commence without an approved QAPP.

2.1 Task 1. Field Study Planning Support

Jacobs will attend field study planning meetings, approximately one hour per week, with the WACOR and additional team members from ORD / Regions / Shelby County. EPA will secure node siting.

2.2 Task 2. Construct and Test Sensor Nodes

Jacobs will design a sensor node that includes the following components: optical particle counter sensor that can measure PM_1, $PM_{2.5}$, and PM_{10} simultaneously (e.g., Alphasense OPCN2), secondary gas or PM sensor to be determined by the WACOR, 2-dimensional wind, temperature, humidity, noise sensor, cellular modem, microprocessor, local memory storage, and power system. The materials cost for each node is anticipated to be approximately $3000. Approximately 25% of the nodes are anticipated to be powered by land-power, with the remaining nodes requiring solar power with a battery back-up. The nodes will be constructed to be weather- and tamper-proof, designed to minimize any bias in the wind sensor readings, and maintain a small footprint. After approval of the node design by the WACOR, Jacobs will construct 16 sensor nodes. EPA will provide 16 machine-to-machine cell service plans, however, Jacobs will be responsible for obtaining cellular modems. Jacobs will review the VIPER documentation and develop the microprocessor code and a supporting supervisory computer to assemble node data and relay it to the VIPER database. The node data structure will be self-identifying, including the longitude and latitude and clear identification of measurements. The VIPER database support is not anticipated to be of any cost to the contractor. After construction, Jacobs will conduct quality checks that will be outlined in a QAPP to be written by the WACOR. Jacobs will conduct a preliminary test of the nodes operability, co-locating all units on the EPA Research Triangle Park, North Carolina campus and operating the units for a minimum of 72 hours. Jacobs will also develop a standard operating protocol for the nodes. If additional funding becomes available or Jacobs is able to construct nodes at a lower cost than estimated, additional nodes (up to 4) may be requested by the WACOR.

Deliverable 2.1: Jacobs will provide a draft node design to the WACOR within 60 days of the WA initiation.

Deliverable 2.2: Jacobs will provide a final node design to the WACOR, within 30 days of receipt of comments from the WACOR.

Deliverable 2.3: Jacobs will document the preliminary test (through photographs, a summary of wireless data communication to VIPER, and all collected node data) to the WACOR within 150 days of the WA initiation.

2.3 Task 3. Field Study Deployment

Jacobs will transport and conduct an initial collocation of all 16 sensor nodes at the National Core Sites (NCore) station in Memphis with previously obtained approval from Shelby County. The collocation of all nodes will be conducted for a 72-hour period. After the collocation is complete, Jacobs will deploy the 16 sensor nodes at preselected locations in Memphis, and conduct on-site quality checks that will be outlined with the QAPP to be provided by the WACOR. After installation, Jacobs will provide a monthly download of the memory card for each node and transmit to the WACOR. Jacobs will provide for

maintenance and repair of the nodes during the six-month field study. At the conclusion of the field study, Jacobs will recover all equipment and restore the sites to their original condition.

Deliverable 3.1: Jacobs will document the collocation through photographs and will deliver the collocation data set to the WACOR, within 30 days of the field study initiation.

Deliverable 3.2: Jacobs will deliver documentation of each node installation through photographs and a written summary of on-site quality checks, within 30 days of the field study initiation.

Deliverable 3.3: Jacobs will deliver the monthly data files to the WACOR within 14 days of each data download.

Task 4.0 The contractor shall construct up to 20 additional pods (solar and land AC power compatible) in accordance with the design and specifications of those being built under the other tasks of this work assignment for the Memphis research study. A total of four of these devices shall be deployed in support of the Memphis field study described in this PWS. The Contractor shall maintain these pods in Memphis, recover data and integrate the data into the overall study database. The Contractor shall also ensure the operational status of all pods using the same laboratory/field test regimen applied under the PWS. These new pods are to be electrically reviewed for safety as they ultimately will be released to external parties. The contractor shall prioritize the development of the four pods being employed in the Memphis field study should be developed in the near term. The remainder shall be delivered fully operational by March 1, 2017.

Deliverable 4.1, Delivery of 4 pods and their operation in CitySpace as per the pods previously defined in Tasks 2 and 3.
Deliverable 4.2 Delivery of the 16 remaining pods by March 1 2017 in full operational order as defined previously in Task 2.

3. Schedule

Jacobs will provide deliverables according to the following schedule. Due dates are dependent on EPA action as noted in the specific deliverable descriptions in Section 2.

Task	Milestone/Deliverable	Estimated Date
2.1	Draft Node Design	06/01/2016
2.2	Final Node Design	07/15/2016
2.3	Preliminary Testing Data	08/15/2016
3.1	Node Collocation Test Results	09/15/2016
3.2	Node Installation Documentation	10/01/2016
3.3	Monthly data downloads	Within 14 days of data download

4.0	Delivery of 4 Pods to meet CitySpace operations	9/15/2016
4.0	Delivery of 16 additional Pods	3/1/2017

4. Quality Assurance/Quality Control (QA/QC)

Field data collection, described in Task 3, will be conducted as detailed in a Category IV/B QAPP provided by EPA. Jacobs will review the QAPP and ensure that it is within the scope of the WA and that it is adequate for this effort. The Jacobs WAL and QA officer will provide written documentation to the WACOR as record that they have reviewed the QAPP and agree that it addresses the needs of this WA and the requirements stated in "NRMRL Quality Assurance Requirements," or Jacobs will respond in writing with suggested revisions to make the QAPP meet the requirements of this WA and the National Risk Management Research Laboratory (NRMRL) requirements. Upon receipt of the concurrence, the EPA WACOR and QA manager will review and approve the QAPP and will add their signatures to the signature page. Work involving environmental data collection will not commence without an approved QAPP.

5. Conflict of Interest Statement

Jacobs certifies that, to the best of our knowledge and belief, all actual or potential organizational conflicts of interest have been reviewed and reported to the Contract-Level Contracting Officer's Representative, or no actual or potential organizational conflicts of interest exist. In addition, Jacobs certifies that our personnel performing the work under this WA or relating to this WA have been informed of their obligation to report personal and organizational conflicts to their supervisor and/or program manager. Jacobs recognizes the continuing obligation to identify and report any actual or potential conflicts of interest arising during performance of this WA.

6. Work Assignment Staffing Plan and Cost Estimate Summary

Jacobs has performed an analysis of each task in this WA, and a summary of the staffing plan and estimate of cost are provided below. The actual work in each task area will depend on the actual work ordered through technical directive. If EPA's priorities or labor requirements change significantly during the course of the WA, the EPA WACOR will issue a WA amendment or modification. Jacobs will then prepare and submit a modified work plan and/or cost estimate.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-039

☐ Other ☒ Amendment Number: 000002

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2017 To 03/31/2018 Base Option Period Number 1	City Space

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 6 & 7

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:
The purpose of this amendment is to change the WACOR to Ronald Williams, the Alternate WACOR to Richard Baldauf and revise the PWS. A revised technical proposal and cost estimate are requested within 7 business days.

Accounting and Appropriations Data

☐ Superfund ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2017 To 03/31/2018 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Ronald Williams	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-2957 FAX Number:
Project Officer Name Robin S. Harris	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-0955 FAX Number:
Other Agency Official Name	(Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Candice Charlton	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2007 FAX Number:

WA 1-039: CitySpace Sensor Network Project

WPS

Amendment-July 25-2016

1. Overview

U.S. Environmental Protection Agency (EPA) Regions are interested in having more granular information on air quality for goals of addressing citizen concerns about nearby sources, supporting siting of regulatory monitoring stations, and increasing knowledge of spatiotemporal variation of air pollution and associated health effects. Until recently, the spatial resolution of air-pollution measurements has been limited by the cost and logistics associated with traditional monitoring approaches. During recent years, there have been significant advances in air-pollution sensor technology which could meet these air-quality characterization needs. Specifically, sensors are now being developed that are much smaller and lower-cost than traditional ambient-air monitoring systems, with promising data. Thus, these sensors can be deployed in much greater density than traditional air-monitoring equipment and provide new insights into air pollution trends.

In order to understand the feasibility of using these new technologies, three EPA Regions (R4, R6, R7) are collaborating with the Office of Research and Development (ORD) to conduct a pilot study implementing particulate matter (PM) sensors at one city (Memphis, Tennessee). The field study also expects to have local partnership of Shelby County Public Health Department, Tennessee. In addition, the field study implementation is anticipated to have data management support from the EPA Office of Land and Emergency Management (OLEM) who manage the VIPER wireless monitoring system (https://www.epaosc.org/site/site_profile.aspx?site_id=5033). The Memphis location was selected based on several factors. For one, the location has completed and has an upcoming significant air toxics study, implemented by the University of Memphis, with over 100 locations that have granted site permission in the past for air toxics monitors to be sited (https://www.shelbycountytn.gov/index.aspx?NID=2754). In addition, Region 4 reviewed the PM monitoring network in Memphis and hypothesized that supplemental monitoring may reveal greater spatiotemporal variability in PM.

2. Technical Approach

The scope of this Work Assignment (WA) is to prepare for and conduct a field study involving the deployment of a 16-node sensor network in Memphis, Tennessee. Jacobs will be responsible for constructing and testing sensor nodes, configuring data reporting to be compatible with the VIPER system, deployment of nodes for a six-month sampling duration, and recovery of equipment after the field study is completed. These steps are described in detail in the tasks below. Field data collection described in the following tasks will be conducted as detailed in a Category IV/B Quality Assurance Project Plan (QAPP), which will be provided to the contractor for concurrence. Jacobs will review each QAPP and ensure that it is within the scope of this statement of work (SOW) and that it is adequate for the implementation of this SOW. The Jacobs WA Leader (WAL) and quality assurance (QA) officer will provide written documentation to the EPA Work Assignment Contracting Officer's Representative (WACOR) as a record that they have reviewed the QAPP and agree that it addresses the needs of this SOW and the requirements in Attachment #1, or Jacobs will respond in writing with suggested revisions to make the QAPP meet the requirements of this SOW and the requirements in Attachment #1. It is the responsibility of the WAL to document this process. Upon receipt of the concurrence, the EPA WACOR and QA manager will review and approve each QAPP and will add their signatures to the signature page. Work involving environmental data collection will not commence without an approved QAPP.

2.1 Task 1. Field Study Planning Support

Jacobs will attend field study planning meetings, approximately one hour per week, with the WACOR and additional team members from ORD / Regions / Shelby County. EPA will secure node siting.

2.2 Task 2. Construct and Test Sensor Nodes

Jacobs will design a sensor node that includes the following components: optical particle counter sensor that can measure PM_1, $PM_{2.5}$, and PM_{10} simultaneously (e.g., Alphasense OPCN2), secondary gas or PM sensor to be determined by the WACOR, 2-dimensional wind, temperature, humidity, noise sensor, cellular modem, microprocessor, local memory storage, and power system. The materials cost for each node is anticipated to be approximately $3000. Approximately 25% of the nodes are anticipated to be powered by land-power, with the remaining nodes requiring solar power with a battery back-up. The nodes will be constructed to be weather- and tamper-proof, designed to minimize any bias in the wind sensor readings, and maintain a small footprint. After approval of the node design by the WACOR, Jacobs will construct 16 sensor nodes. EPA will provide 16 machine-to-machine cell service plans, however, Jacobs will be responsible for obtaining cellular modems. Jacobs will review the VIPER documentation and develop the microprocessor code and a supporting supervisory computer to assemble node data and relay it to the VIPER database. The node data structure will be self-identifying, including the longitude and latitude and clear identification of measurements. The VIPER database support is not anticipated to be of any cost to the contractor. After construction, Jacobs will conduct quality checks that will be outlined in a QAPP to be written by the WACOR. Jacobs will conduct a preliminary test of the nodes operability, co-locating all units on the EPA Research Triangle Park, North Carolina campus and operating the units for a minimum of 72 hours. Jacobs will also develop a standard operating protocol for the nodes. If additional funding becomes available or Jacobs is able to construct nodes at a lower cost than estimated, additional nodes (up to 4) may be requested by the WACOR.

Deliverable 2.1: Jacobs will provide a draft node design to the WACOR within 60 days of the WA initiation.

Deliverable 2.2: Jacobs will provide a final node design to the WACOR, within 30 days of receipt of comments from the WACOR.

Deliverable 2.3: Jacobs will document the preliminary test (through photographs, a summary of wireless data communication to VIPER, and all collected node data) to the WACOR within 150 days of the WA initiation.

2.3 Task 3. Field Study Deployment

Jacobs will transport and conduct an initial collocation of all 16 sensor nodes at the National Core Sites (NCore) station in Memphis with previously obtained approval from Shelby County. The collocation of all nodes will be conducted for a 72-hour period. After the collocation is complete, Jacobs will deploy the 16 sensor nodes at preselected locations in Memphis, and conduct on-site quality checks that will be outlined with the QAPP to be provided by the WACOR. After installation, Jacobs will provide a monthly download of the memory card for each node and transmit to the WACOR. Jacobs will provide for

maintenance and repair of the nodes during the six-month field study. At the conclusion of the field study, Jacobs will recover all equipment and restore the sites to their original condition.

Deliverable 3.1: Jacobs will document the collocation through photographs and will deliver the collocation data set to the WACOR, within 30 days of the field study initiation.

Deliverable 3.2: Jacobs will deliver documentation of each node installation through photographs and a written summary of on-site quality checks, within 30 days of the field study initiation.

Deliverable 3.3: Jacobs will deliver the monthly data files to the WACOR within 14 days of each data download.

Task 4.0 ~~The contractor shall construct up to 20 additional pods (solar and land AC power compatible) in accordance with the design and specifications of those being built under the other tasks of this work assignment for the Memphis research study. A total of four of these devices shall be deployed in support of the Memphis field study described in this PWS. The Contractor shall maintain these pods in Memphis, recover data and integrate the data into the overall study database. The Contractor shall also ensure the operational status of all pods using the same laboratory/field test regimen applied under the PWS. These new pods are to be electrically reviewed for safety as they ultimately will be released to external parties. The contractor shall prioritize the development of the four pods being employed in the Memphis field study should be developed in the near term. The remainder shall be delivered fully operational by March 1, 2017.~~The Contractor shall develop or maintain only pods currently operating in Memphis as of ~~Dec 7~~Jan 12, 201~~5~~7 and as defined by the QAPP. Non-operational pods in the Contractor's possession shall be held without repair. Repair of pods in Memphis shall be performed only under written technical direction of the WA COR.

Deliverable 4.1, Delivery of 4 pods and their operation in CitySpace as per the pods previously defined in Tasks 2 and 3.
~~Deliverable 4.2 Delivery of the 16 remaining pods by March 1 2017 in full operational order as defined previously in Task 2.~~

3. Schedule

Jacobs will provide deliverables according to the following schedule. Due dates are dependent on EPA action as noted in the specific deliverable descriptions in Section 2.

Task	Milestone/Deliverable	Estimated Date
2.1	Draft Node Design	06/01/2016
2.2	Final Node Design	07/15/2016
2.3	Preliminary Testing Data	08/15/2016
3.1	Node Collocation Test Results	09/15/2016
3.2	Node Installation Documentation	10/01/2016

3.3	Monthly data downloads	Within 14 days of data download
4.0	Delivery of 4 Pods to meet CitySpace operations as of Jan~~Dec 7,~~ 17, 2017~~7~~	3/1/17~~9/15/2016~~
~~4.0~~	~~Delivery of 16 additional Pods~~	~~3/1/2017~~

4. Quality Assurance/Quality Control (QA/QC)

Field data collection, described in Task 3, will be conducted as detailed in a Category IV/B QAPP provided by EPA. Jacobs will review the QAPP and ensure that it is within the scope of the WA and that it is adequate for this effort. The Jacobs WAL and QA officer will provide written documentation to the WACOR as record that they have reviewed the QAPP and agree that it addresses the needs of this WA and the requirements stated in "NRMRL Quality Assurance Requirements," or Jacobs will respond in writing with suggested revisions to make the QAPP meet the requirements of this WA and the National Risk Management Research Laboratory (NRMRL) requirements. Upon receipt of the concurrence, the EPA WACOR and QA manager will review and approve the QAPP and will add their signatures to the signature page. Work involving environmental data collection will not commence without an approved QAPP.

5. Conflict of Interest Statement

Jacobs certifies that, to the best of our knowledge and belief, all actual or potential organizational conflicts of interest have been reviewed and reported to the Contract-Level Contracting Officer's Representative, or no actual or potential organizational conflicts of interest exist. In addition, Jacobs certifies that our personnel performing the work under this WA or relating to this WA have been informed of their obligation to report personal and organizational conflicts to their supervisor and/or program manager. Jacobs recognizes the continuing obligation to identify and report any actual or potential conflicts of interest arising during performance of this WA.

6. Work Assignment Staffing Plan and Cost Estimate Summary

Jacobs has performed an analysis of each task in this WA, and a summary of the staffing plan and estimate of cost are provided below. The actual work in each task area will depend on the actual work ordered through technical directive. If EPA's priorities or labor requirements change significantly during the course of the WA, the EPA WACOR will issue a WA amendment or modification. Jacobs will then prepare and submit a modified work plan and/or cost estimate.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-040

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Xiaoyu Liu	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-2459
			FAX Number:
Project Officer Name Robin Baily	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-7906
			FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code:
			Phone Number:
			FAX Number:
Contracting Official Name Mark Cranley	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-487-2351
			FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Chamber Testing for Tire Crumb Research Study

WA #: 1-040 WACOR: Xiaoyu Liu

Contract #: EP-C-15-008 Alternate WACOR:

PERIOD OF PERFORMANCE:

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

The overall objective of this project is to identify and characterize constituents, emissions, and potential exposure of recycled rubber tire crumbs. It is to support federal effort to better understand the manufacturing and use for recycled tire-derived playground surface materials. This project is to conduct small and micro chamber tests to characterize the potential Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOCs) emissions from recycled rubber tire crumbs.

BACKGROUND

Concerns have been raised about the safety of recycled rubber tire crumbs used in synthetic turf fields in the United States. The studies conducted to date have not shown elevated health risks from playing on fields with synthetic turf. However, these studies have various limitations and do not comprehensively address the concerns about the potential health risks associated with exposure to constituents in the tire crumb. Because of these health concerns and the need for additional information, federal partners are working together over the next 12 months to fill in important data gaps, particularly with respect to understanding potential exposures to constituents in the tire crumbs. Additionally, concerns about crumb rubber use in athletic fields have led to concerns by the public about the safety of other uses of recycled tires, such as those processed into playground surface materials and rubber tire mulch used on playgrounds, in both cases to protect against impact injuries.

Recycled rubber tire crumbs are a complex materials, have the potential to release a variety of chemicals and particles to the air under various weathering conditions. A study is need to identify and quantify chemical emissions, including VOCs and

SVOCs under different weathering conditions, e.g. temperature, humidity, and UV light.

SCOPE

For the project, the Contractor shall provide technical support to EPA by developing sampling methods and conducting small chamber and micro chamber tests for the project. A series of chamber tests will be mainly conducted between May 1 and July 31, 2016. The tasks are listed below.

TECHNICAL APROACH/OBJECTIVES

The contractor shall conduct the following tasks:

Task 1. Set up Testing and Sampling Systems for Tire Crumb Tests

Testing chambers, such as small chamber and micro chamber systems, will be used for the project. Two micro chamber systems and four to eight small chambers are to be used under at least two temperature conditions. The tests will be conducted under 25°C and 60°C with 50% relative humidity. The WACOR will identify other test conditions and sampling media once the project plan is finalized. The contractor shall set up and optimize all chamber testing and sampling systems with the specified test conditions.

Tasks 2. Prepare QAPP and SOPs

The contractor shall prepare the QAPP for the project. SOPs will be prepared as needed. This project will be QA category A. Work shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff.

Task 3. Conduct Chamber Tests

The contractor shall conduct small chamber and micro chamber tests and collect air samples from the chambers. The tire crumbs for testing will be provided by the WACOR. The samples will be collected at defined time. One time series test will be conducted for each type of chambers under 25°C and 60°C. After collection, the sampling media will be sent to the researchers at National Exposure Research Laboratory (NERL) for VOCs and SVOCs analysis. The contractor shall provide Chain-of-Custody to document tire crumbs sample receiving, air sample collection, and sample media delivering.

QUALITY ASSURANCE

The contractor shall adhere to the QA requirements as delineated in Attachment #1 to the Statement of Work.

DELIVERABLES and SCHEDULE of DELIVERABLES

The Contractor shall submit the QAPP within 30 days of receiving the directions from the WACOR.

The Contractor shall finish about 150 micro chamber tests and 150 small chamber tests between May 1 and July 31, 2016. The final number of tests will be notified by WACOR when the project plan is finalized. The Contractor shall also provide (1) test material information; (2) Chain-of-Custody; (3) environmental data for each test; (3) sampling information. These shall be submitted to the WACOR within 5 business days after each test.

The Contractor shall provide the EPA WACOR biweekly progress reports as specified in the contract. The Contractor shall alert the WACOR in advance if they expect a substantial delay in completing the task or submitting the deliverable.

The Contractor shall provide necessary health and safety protocol and documentation.

ATTACHMENT #1 TO STATEMENT OF WORK FOR QA CATEGORY II PROJECTS

NRMRL QA Requirements and Definitions

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation described herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The QAPP shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government.

Definitions:

Environmental Data - These are any measurements or information that describe environmental processes, location, or conditions; ecological or health effects and consequences; or the performance of

environmental technology. For EPA, environmental data include information collected directly from measurements, produced from software and models, and compiled from other sources such as data bases or the literature.

Quality Assurance (QA) - Quality assurance is a system of management activities to ensure that a process, item, or service is of the type and quality needed by the customer. It deals with setting policy and running an administrative system of management controls that cover planning, implementation, and review of data collection activities and the use of data in decision making. Quality assurance is just one part of a quality system.

Quality Assurance Project Plan (QAPP) - A QAPP is a document that describes the necessary quality assurance, quality control, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. A QAPP documents project-specific information.

Quality Control (QC) - Quality control is a technical function that includes all the scientific precautions, such as calibrations and duplications, that are needed to acquire data of known and adequate quality.

Quality Management Plan (QMP) - A QMP is a document that describes an organization's/program's quality system in terms of the organizational structure, policy and procedures, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, documenting, and assessing all activities conducted. A QMP documents the overall organization/program, and is primarily applicable to multi-year, multi-project efforts. An organization's/program's QMP shall address all elements listed in the "Requirements for Quality Management Plans" in Appendix B of the NRMRL QMP.

Quality System - A quality system is the means by which an organization manages its quality aspects in a systematic, organized manner and provides a framework for planning, implementing, and assessing work performed by an organization and for carrying out required quality assurance and quality control activities.

R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

Substantive Change - Substantive change is any change in an activity that may alter the quality of data being used, generated, or gathered.

EPA's Quality System Website: http://www.epa.gov/quality/

EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

Category Level Designations (determines the level of QA required):

- ☐ **Category I Project** - applicable to studies performed to generate data used for enforcement activities, litigation, or research project involving human subjects. The QAPP shall address all elements listed in R-5.
- X **Category II Project** - applicable to studies performed to generate data used in support of the development of environmental regulations or standards. The QAPP shall address all elements listed in R-5.
- ☐ **Category III Project** - applicable to projects involving applied research or technology evaluations. The QAPP shall address the applicable sections of R-5, as outlined in the NRMRL QAPP requirements for the specific project type.
- ☐ **Category IV Project** - applicable to projects involving basic research or preliminary data gathering activities. The QAPP shall address the applicable sections of R-5, as outlined in the NRMRL QAPP requirements for the specific project type.

Suggested Content for Required Elements of QA Project Plans as per R-5:

GROUP A PROJECT MANAGEMENT

There are nine elements in this group. These address project administrative functions and project concerns, goal(s), and approach(es) to be followed.

Element A1- Title and Approval Sheet

- Project title
- Organization name
- Names, titles, signatures, and signature dates of the approving officials

Element A2- Table of Contents

- Table of Contents;
- List of Figures, Tables, References and Appendices
- Document control format

Element A3- Distribution List

Names of individuals and organization(s) to receive a copy of the approved QA Project Plan

Element A4- Project/Task Organization

- List of individuals and organizations involved with the project, identifying their roles and responsibilities

- Documentation of project QA Manager's independence
- Identification of the individual responsible for maintaining the official, approved QA Project Plan
- Organizational chart showing relationships and lines of communication among project personnel

Element A5- Problem Definition/Background

- Statement of specific problem to be solved, decision to be made, or outcome to be achieved
- Background information

Element A6- Project/Task Description

- Summary of work to be performed and products
- Project schedule
- Maps, tables, etc. showing geographic locations

Element A7- Quality Objectives and Criteria

- Outputs from the systematic planning process (e.g., DQOs) used to design the study
- Measurement performance or acceptance criteria established as part of the study design. These relate the quality of data needed to the established limits on the chance of making a decision error or of incorrectly answering a study question

Element A8- Special Training/Certifications

- Description of how the most current approved QA Project Plan will be distributed to project staff
- List of records to be included in the data report package
- List of any other project documents to be produced
- Information on the final disposition of records and documents, including location and retention schedule

Element A9- Documentation and Records

- Any specialized training or certifications needed by personnel
- Plans for providing, documenting, and assuring this training

GROUP B: DATA GENERATION AND ACQUISITION

The ten elements in this group address data generation and data acquisition and management activities.

Element B1- Sampling Process Design (Experimental Design)

Description of project's experimental design

Element B2- Sampling Methods

- Description of sample/data collection procedures
- List of equipment needed

- Identification of performance requirements
- Description of corrective actions to be taken if problems arise

Element B3- Sample Handling and Custody

Description of sample handling requirements and transfer, and for ultimate disposal

Element B4- Analytical Methods

- Description of analytical methods to be used
- Identification of any performance criteria
- Description of corrective actions when problems arise

Element B5- Quality Control

- List of QC activities needed for sampling, analytical, or measurement techniques, along with their frequency
- Description of control limits for each QC activity and corrective actions when these are exceeded
- Identification of any applicable statistics to be used

Element B6- Instrument/Equipment Testing, Inspection, and Maintenance

- List of equipment and/or systems needing periodic maintenance, testing, or inspection, and the schedule for such
- Description of how inspections and periodic preventive maintenance procedures will be performed and documented
- Discussion on how critical spare parts will be supplied and stocked
- Description of how re-inspections will be performed and effectiveness of corrective actions determined and documented

Element B7- Instrument/Equipment Calibration and Frequency

- List of all project tools, gauges, instruments, and other sampling, measuring, and test equipment which should be calibrated
- Description of calibration method and identification of any certified equipment and/or standards to be used
- Details of how calibration records will be maintained and traceable to the instrument/ equipment

Element B8- Inspection/Acceptance of Supplies and Consumables

- A list of project supplies and consumables that may directly or indirectly affect the quality of the results
- The acceptance criteria for them
- Identification of those responsible

Element B9- Non-direct Measurements

- Identification of any existing data that will be obtained from non-measurement sources, such as literature files and historical databases
- Description of how you intend to use the data
- Your acceptance criteria and any limitations for using such data

Element B10- Data Management

- Description of the project data management process
- Description of or reference to the office's standard record-keeping procedures and document control, data storage, retrieval, and security systems
- Identification of data handling equipment and procedures to process, compile, and analyze project data
- Discussion of data handling procedures to detect and correct errors and loss during data processing
- Examples of any forms or checklists to be used
- Identification of any specific computer hardware/software performance requirements and how configuration acceptability will be determined
- Description of how applicable information resource management requirements will be satisfied, as well as any applicable Agency information resource management requirements (EPA Directive 2100, EPA QA Project Plans only)

GROUP C: ASSESSMENT AND OVERSIGHT

Assessments or evaluations are designed to determine whether the QA Project Plan is being implemented as approved (conformance/nonconformance), to increase confidence in the information obtained, and ultimately to determine whether the information may be used for their intended purpose. The two elements in this group detail what assessments or evaluations will occur both during and after the project. Data assessments, such as data verification and validation, are discussed in the Group D elements.

Element C1- Assessments and Response Actions

- Description of project assessments planned and a brief discussion of the information expected
- Approximate schedule for these assessments and their reports
- For any planned self-assessments, identification of potential participants and their relationship within the project organization
- For independent assessments, identification of the organization and person(s) that will conduct the assessments
- Identification of how, when, and to whom the results of each assessment will be reported and corrective actions implemented

Element C2- Reports to Management

- Frequency and distribution of reports to inform management (EPA or otherwise) of the project's status

- Identification of report preparer and recipients, as well as any specific actions or recommendations recipients are expected to make

GROUP D: DATA VALIDATION AND USABILITY

The three elements in this group address the final project checks to see if the data or product obtained will conform to the project's objectives, and to estimate the effect of any deviations. For projects that use existing data, these elements focus on evaluating how data values from these acquired data sets will be used to determine the quality objectives for the new data use. For a modeling project, this process is similar to confirming that the steps in the modeling process were followed correctly to produce the model outputs and that the results meet project objectives.

Element D1- Data Review, Verification, and Validation

State the criteria for deciding to accept, reject, or qualify project data in an objective and consistent manner

Element D2- Verification and Validation Methods

- Description of how project data will be verified and validated
- Discussion of how any issues will be resolved and identification of who has the authority for resolving them
- Description of how results will be conveyed to data users
- Explanation of how validation issues differ from verification issues for this project
- Examples of any forms or checklists to be used and identification of any project-specific calculations

Element D3- Reconciliation with User Requirements

- Description of how project results will be reconciled with the requirements defined by the data user or decision maker
- An outline of methods proposed to analyze the data and determine possible anomalies or departures from assumptions made when the project was planned
- Description of how reconciliation with user requirements will be documented, issues will be resolved, and how limitations on the use of the data will be reported to decision makers

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-040

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2016
Base Option Period Number 1

Title of Work Assignment/SF Site Name: Amd 1

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Xiaoyu Liu
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-2459
FAX Number:

Project Officer Name Robin S. Harris
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0955
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Statement of Work Amendment 1

WA Title: Chamber Testing for Tire Crumb Research Study

WA #: 1-040-1 WACOR: Xiaoyu Liu

Contract #: EP-C-15-008 Alternate WACOR:

PERIOD OF PERFORMANCE:

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

AMENDMENT

The scope of the work in the original work assignment was scheduled to be finished by July 31, 2016. This amendment is to extend completion of approximately 164 small chamber and 164 micro chamber tests, by December 15, 2016, depending on the status of the tire crumb sample collection.

SUMMARY OF OBJECTIVES

The overall objective of this project is to identify and characterize constituents, emissions, and potential exposure of recycled rubber tire crumbs. It is to support federal effort to better understand the manufacturing and use for recycled tire-derived playground surface materials. This project is to conduct small and micro chamber tests to characterize the potential Volatile Organic Compounds (VOCs) and Semi-Volatile Organic Compounds (SVOCs) emissions from recycled rubber tire crumbs.

BACKGROUND

Concerns have been raised about the safety of recycled rubber tire crumbs used in synthetic turf fields in the United States. The studies conducted to date have not shown elevated health risks from playing on fields with synthetic turf. However, these studies have various limitations and do not comprehensively address the concerns about the potential health risks associated with exposure to constituents in the tire crumb. Because of these health concerns and the need for additional information, federal partners are working together over the next 12 months to fill in important data gaps, particularly with respect to understanding potential exposures

to constituents in the tire crumbs. Additionally, concerns about crumb rubber use in athletic fields have led to concerns by the public about the safety of other uses of recycled tires, such as those processed into playground surface materials and rubber tire mulch used on playgrounds, in both cases to protect against impact injuries.

Recycled rubber tire crumbs are a complex materials, have the potential to release a variety of chemicals and particles to the air under various weathering conditions. A study is need to identify and quantify chemical emissions, including VOCs and SVOCs under different weathering conditions, e.g. temperature, humidity, and UV light.

SCOPE

For the project, the Contractor shall provide technical support to EPA by developing sampling methods and conducting small chamber and micro chamber tests for the project. A series of chamber tests will be mainly conducted between May 1 and July 31, 2016. The tasks are listed below.

TECHNICAL APROACH/OBJECTIVES

The contractor shall conduct the following tasks:

Task 1. Set up Testing and Sampling Systems for Tire Crumb Tests

Testing chambers, such as small chamber and micro chamber systems, will be used for the project. Two micro chamber systems and four to eight small chambers are to be used under at least two temperature conditions. The tests will be conducted under 25°C and 60°C with 50% relative humidity. The WACOR will identify other test conditions and sampling media once the project plan is finalized. The contractor shall set up and optimize all chamber testing and sampling systems with the specified test conditions.

Tasks 2. Prepare QAPP and SOPs

The contractor shall prepare the QAPP for the project. SOPs will be prepared as needed. This project will be QA category A. Work shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff.

Task 3. Conduct Chamber Tests

The contractor shall conduct small chamber and micro chamber tests and collect air samples from the chambers. The tire crumbs for testing will be provided by the WACOR. The samples will be collected at defined time. One time series test will be conducted for each type of chambers under 25°C and 60°C. After collection, the sampling media will be sent to the researchers at National Exposure Research Laboratory (NERL) for VOCs and SVOCs analysis. The contractor shall provide Chain-of-Custody to document tire crumbs sample receiving, air sample collection, and sample media delivering.

QUALITY ASSURANCE

The contractor shall adhere to the QA requirements as delineated in Attachment #1 to the Statement of Work.

DELIVERABLES and SCHEDULE of DELIVERABLES

The Contractor shall submit the QAPP within 30 days of receiving the directions from the WACOR.

The Contractor shall finish about 150 micro chamber tests and 150 small chamber tests between May 1 and July 31, 2016. The final number of tests will be notified by WACOR when the project plan is finalized. The Contractor shall also provide (1) test material information; (2) Chain-of-Custody; (3) environmental data for each test; (3) sampling information. These shall be submitted to the WACOR within 5 business days after each test.

The Contractor shall provide the EPA WACOR biweekly progress reports as specified in the contract. The Contractor shall alert the WACOR in advance if they expect a substantial delay in completing the task or submitting the deliverable.

The Contractor shall provide necessary health and safety protocol and documentation.

ATTACHMENT #1 TO STATEMENT OF WORK FOR QA CATEGORY II PROJECTS

NRMRL QA Requirements and Definitions

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation described herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the

Government has approved the quality documentation. The QAPP shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government.

Definitions:

Environmental Data - These are any measurements or information that describe environmental processes, location, or conditions; ecological or health effects and consequences; or the performance of environmental technology. For EPA, environmental data include information collected directly from measurements, produced from software and models, and compiled from other sources such as data bases or the literature.

Quality Assurance (QA) - Quality assurance is a system of management activities to ensure that a process, item, or service is of the type and quality needed by the customer. It deals with setting policy and running an administrative system of management controls that cover planning, implementation, and review of data collection activities and the use of data in decision making. Quality assurance is just one part of a quality system.

Quality Assurance Project Plan (QAPP) - A QAPP is a document that describes the necessary quality assurance, quality control, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. A QAPP documents project-specific information.

Quality Control (QC) - Quality control is a technical function that includes all the scientific precautions, such as calibrations and duplications, that are needed to acquire data of known and adequate quality.

Quality Management Plan (QMP) - A QMP is a document that describes an organization's/program's quality system in terms of the organizational structure, policy and procedures, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, documenting, and assessing all activities conducted. A QMP documents the overall organization/program, and is primarily applicable to multi-year, multi-project efforts. An organization's/program's QMP shall address all elements listed in the "Requirements for Quality Management Plans" in Appendix B of the NRMRL QMP.

Quality System - A quality system is the means by which an organization manages its quality aspects in a systematic, organized manner and provides a framework for planning, implementing, and assessing work performed by an organization and for carrying out required quality assurance and quality control activities.

R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001, http://www.epa.gov/quality/qs-docs/r2-final.pdf

R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

Substantive Change - Substantive change is any change in an activity that may alter the quality of data being used, generated, or gathered.

EPA's Quality System Website: http://www.epa.gov/quality/

EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

□ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

Category Level Designations (determines the level of QA required):

□ **Category I Project** - applicable to studies performed to generate data used for enforcement activities, litigation, or research project involving human subjects. The QAPP shall address all elements listed in R-5.

X **Category II Project** - applicable to studies performed to generate data used in support of the development of environmental regulations or standards. The QAPP shall address all elements listed in R-5.

□ **Category III Project** - applicable to projects involving applied research or technology evaluations. The QAPP shall address the applicable sections of R-5, as outlined in the NRMRL QAPP requirements for the specific project type.

□ **Category IV Project** - applicable to projects involving basic research or preliminary data gathering activities. The QAPP shall address the applicable sections of R-5, as outlined in the NRMRL QAPP requirements for the specific project type.

Suggested Content for Required Elements of QA Project Plans as per R-5:

GROUP A PROJECT MANAGEMENT

There are nine elements in this group. These address project administrative functions and project concerns, goal(s), and approach(es) to be followed.

Element A1- Title and Approval Sheet

- Project title
- Organization name
- Names, titles, signatures, and signature dates of the approving officials

Element A2- Table of Contents

- Table of Contents;
- List of Figures, Tables, References and Appendices

- Document control format

Element A3- Distribution List

Names of individuals and organization(s) to receive a copy of the approved QA Project Plan

Element A4- Project/Task Organization

- List of individuals and organizations involved with the project, identifying their roles and responsibilities
- Documentation of project QA Manager's independence
- Identification of the individual responsible for maintaining the official, approved QA Project Plan
- Organizational chart showing relationships and lines of communication among project personnel

Element A5- Problem Definition/Background

- Statement of specific problem to be solved, decision to be made, or outcome to be achieved
- Background information

Element A6- Project/Task Description

- Summary of work to be performed and products
- Project schedule
- Maps, tables, etc. showing geographic locations

Element A7- Quality Objectives and Criteria

- Outputs from the systematic planning process (e.g., DQOs) used to design the study
- Measurement performance or acceptance criteria established as part of the study design. These relate the quality of data needed to the established limits on the chance of making a decision error or of incorrectly answering a study question

Element A8- Special Training/Certifications

- Description of how the most current approved QA Project Plan will be distributed to project staff
- List of records to be included in the data report package
- List of any other project documents to be produced
- Information on the final disposition of records and documents, including location and retention schedule

Element A9- Documentation and Records

- Any specialized training or certifications needed by personnel
- Plans for providing, documenting, and assuring this training

GROUP B: DATA GENERATION AND ACQUISITION

The ten elements in this group address data generation and data acquisition and management activities.

Element B1- Sampling Process Design (Experimental Design)

Description of project's experimental design

Element B2- Sampling Methods

- Description of sample/data collection procedures
- List of equipment needed
- Identification of performance requirements
- Description of corrective actions to be taken if problems arise

Element B3- Sample Handling and Custody

Description of sample handling requirements and transfer, and for ultimate disposal

Element B4- Analytical Methods

- Description of analytical methods to be used
- Identification of any performance criteria
- Description of corrective actions when problems arise

Element B5- Quality Control

- List of QC activities needed for sampling, analytical, or measurement techniques, along with their frequency
- Description of control limits for each QC activity and corrective actions when these are exceeded
- Identification of any applicable statistics to be used

Element B6- Instrument/Equipment Testing, Inspection, and Maintenance

- List of equipment and/or systems needing periodic maintenance, testing, or inspection, and the schedule for such
- Description of how inspections and periodic preventive maintenance procedures will be performed and documented
- Discussion on how critical spare parts will be supplied and stocked
- Description of how re-inspections will be performed and effectiveness of corrective actions determined and documented

Element B7- Instrument/Equipment Calibration and Frequency

- List of all project tools, gauges, instruments, and other sampling, measuring, and test equipment which should be calibrated
- Description of calibration method and identification of any certified equipment and/or standards to be used
- Details of how calibration records will be maintained and traceable to the instrument/ equipment

Element B8- Inspection/Acceptance of Supplies and Consumables

- A list of project supplies and consumables that may directly or indirectly affect the quality of the results
- The acceptance criteria for them
- Identification of those responsible

Element B9- Non-direct Measurements

- Identification of any existing data that will be obtained from non-measurement sources, such as literature files and historical databases
- Description of how you intend to use the data
- Your acceptance criteria and any limitations for using such data

Element B10- Data Management

- Description of the project data management process
- Description of or reference to the office's standard record-keeping procedures and document control, data storage, retrieval, and security systems
- Identification of data handling equipment and procedures to process, compile, and analyze project data
- Discussion of data handling procedures to detect and correct errors and loss during data processing
- Examples of any forms or checklists to be used
- Identification of any specific computer hardware/software performance requirements and how configuration acceptability will be determined
- Description of how applicable information resource management requirements will be satisfied, as well as any applicable Agency information resource management requirements (EPA Directive 2100, EPA QA Project Plans only)

GROUP C: ASSESSMENT AND OVERSIGHT

Assessments or evaluations are designed to determine whether the QA Project Plan is being implemented as approved (conformance/nonconformance), to increase confidence in the information obtained, and ultimately to determine whether the information may be used for their intended purpose. The two elements in this group detail what assessments or evaluations will occur both during and after the project. Data assessments, such as data verification and validation, are discussed in the Group D elements.

Element C1- Assessments and Response Actions

- Description of project assessments planned and a brief discussion of the information expected
- Approximate schedule for these assessments and their reports
- For any planned self-assessments, identification of potential participants and their relationship within the project organization

- For independent assessments, identification of the organization and person(s) that will conduct the assessments
- Identification of how, when, and to whom the results of each assessment will be reported and corrective actions implemented

Element C2- Reports to Management

- Frequency and distribution of reports to inform management (EPA or otherwise) of the project's status
- Identification of report preparer and recipients, as well as any specific actions or recommendations recipients are expected to make

GROUP D: DATA VALIDATION AND USABILITY

The three elements in this group address the final project checks to see if the data or product obtained will conform to the project's objectives, and to estimate the effect of any deviations. For projects that use existing data, these elements focus on evaluating how data values from these acquired data sets will be used to determine the quality objectives for the new data use. For a modeling project, this process is similar to confirming that the steps in the modeling process were followed correctly to produce the model outputs and that the results meet project objectives.

Element D1- Data Review, Verification, and Validation

State the criteria for deciding to accept, reject, or qualify project data in an objective and consistent manner

Element D2- Verification and Validation Methods

- Description of how project data will be verified and validated
- Discussion of how any issues will be resolved and identification of who has the authority for resolving them
- Description of how results will be conveyed to data users
- Explanation of how validation issues differ from verification issues for this project
- Examples of any forms or checklists to be used and identification of any project-specific calculations

Element D3- Reconciliation with User Requirements

- Description of how project results will be reconciled with the requirements defined by the data user or decision maker
- An outline of methods proposed to analyze the data and determine possible anomalies or departures from assumptions made when the project was planned
- Description of how reconciliation with user requirements will be documented, issues will be resolved, and how limitations on the use of the data will be reported to decision makers

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-041

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base Option Period Number 1	Organic Leaching Tests

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 06/06/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Cost/Fee	LOE
Contract Period: 04/01/2015 To 03/31/2017		0
This Action:		1,712
Total:		1,712

Work Plan / Cost Estimate Approvals

	Cost/Fee	LOE
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Susan Thorneloe	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-2709 FAX Number:
Project Officer Name: Robin Baily	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:
Other Agency Official Name:	(Signature)	(Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Mark Cranley	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

Performance Work Statement

WA Title: **Organic Leaching Tests for evaluating environmental release of organic constituents for use by decision makers under RCRA and CERCLA programs**

WA #: 1- 041 WACOR: Susan Thorneloe

Contract #: EP-C-15-008

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES: To develop the conceptual framework so that leaching methods for release of organic constituents (with emphasis on non- and semi-volatile organic constituents) can be implemented to evaluate the range of matrices found in both CERCLA and RCRA applications where leaching of organics is a likely pathway for environmental release.

BACKGROUND: A workshop was conducted in September 2015 to identify the drivers that influence leaching of organics (including semi- and non-volatiles) that can mobilize pollutants and allow there release to the environment. The workshop report has been cleared for publication and a copy of the workshop is available to the contractor. Since the funding for this work is through superfund, this work assignment will be focused on leaching of organics and a companion work assignment (1-007) will be amended to reflect that decision. Fate and transport modeling is not part of the work to be done as part of this work assignment. The main output from leaching tests is on the development of source terms.

SCOPE

1. ***Development/Modification/Compliance with QAPP***: The contractor shall develop quality assurance documentation as required in Appendices #1, 2, and 3 to this Statement of Work. Any work involving environmental data shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff. The contractor shall comply with all requirements as delineated on the "Quality Assurance Review Form" included with this extramural activity.

2. Identify matrices to evaluate. This leaching test will be applied to both RCRA and CERCLA waste streams. Understanding the matrix is critical to identifying a conceptual approach in evaluating leaching. The WA COR will initiate meetings that will be used to get input from representatives of the Office of Land and Emergency Management (OLEM) and to identify sources where waste should be obtained. We do know that solidification/stabilization (S/S) is a priority for inclusion in the initial phase of this research. OLEM reports that S/S is used on chlorinated solvent and polycyclic aromatic hydrocarbon (PAH) dense non-aqueous phase liquid (DNAPLs). OLEM has identified that stabilized volatile organic compounds must also be considered for leaching tests. Another concern identified by OLEM is on how possible treatment options might impact the leach test (i.e., to include both PAH and chlorinated solvent DNAPL, each stabilized with a cement mixture, a cement/activated carbon mixture, and a cement/organoclay mixture).

The Contractor shall identify priority matrices using information referenced below and in discussion with OLEM colleagues who these methods are being developed to support program goals. The Contractor shall review information found at the links below and reports referenced. The WA COR can provide access to any documents not easily found on web links.

https://clu-in.org/contaminantfocus/default.focus/sec/Dense_Nonaqueous_Phase_Liquids_(DNAPLs)/cat/Chemistry_and_Behavior/

Stabilization and Solidification of Contaminated Soil and Waste: A Manual of Practice
Bates, E. and C. Hills.
Hygge Media, 603 pp, 2015

Included are references to numerous case studies and an extensive reference list of completed projects that successfully employed S/S.

Development of Performance Specifications for Solidification/Stabilization
(SS-1) Jul-11 (ITRCP)

From Clu-In:

Solidification: ***Application***

This section contains several examples of site-specific applications of S/S with particular emphasis on coal tar (PAH), creosote (PAH) and chromium

contamination. It does not include sites where the sole purpose of the S/S was to prepare contaminated soils for off-site disposal at a RCRA Subtitle D facility or where the contaminated soil was transported to a licensed RCRA Subtitle C facility for treatment prior to landfilling.

- Chromium
- Coal Tar
- Creosote

From **Evaluation of the Effectiveness of In-Situ Solidification/Stabilization at the Columbus, Georgia Manufactured Gas Plant Site**
Electric Power Research Institute (EPRI), 56 pp, 2003

Table 5-2
Summarized Leachate Data from Core Samples

Location	PAH (ug/l)	BTEX (ug/l)	Cyanide (ug/l)
Blank	ND	<2	NT
S1-1	Naphthalene Acenapthene	<2	NT
S1-2	Naphthalene Acenapthene	<2	NT
S1-3	Acenapthene Naphthalene	<2	NT
S2-2	Naphthalene	<2	NT
S2-3	Acenapthene Fluorene Naphthalene	<2	NT
S3-1	Acenapthene Acenaphthylene Anthracene Fluoranthene Fluorene Naphthalene Phenanthrene Pyrene	Benzene Toluene Xylene	NT
S3-2	Acenapthene Naphthalene	<2	NT
S3-3	Acenapthene Fluorene Naphthalene	<2	NT
S4-1	Naphthalene	<2	<200
S4-2	ND	<2	<200
S4-3	Naphthalene	<2	<200
S5-1	Naphthalene	<2	NT
S5-2	Naphthalene	<2	NT
S5-3	Naphthalene	<2	NT

(ND) Not Detected
(NT) Not Tested

From **Solidification/Stabilization for Remediation of Wood Preserving Sites: Treatment for Dioxins, PCP, Creosote, and Metals (Abstract)**

Bates, E.R., E. Sahle-Demessie, and D.W. Grosse.
Remediation Journal 10(3):51-65(2000)

Exhibit 1. Remediation of the SPT Site[a]

Parameter	Measurement Method[b]	Untreated mg/Kg (mg/L)	Action Level mg/Kg (mg/L)[c]	Treatment Criteria mg/Kg (mg/L)[d]		Actual Performance mg/Kg (mg/L)	
					Samples[e]	Mean	Hi
As/total	7060	1500	25	ok	ok	ok	o
As TCLP	1311 & 6010	10	5.0	5.0	543	<0.1	0
PCP Total	8040	3000	17	ok	--	–	-
PCP TCLP	1311	3.1	0.300	0.300	543	<0.1	0.
PCP SPLP	1312	39	–	–	–	<0.1	.
Cr Total	6010	2000	3910	–	–	–	.
Cr (Total) via TCLP	1311 & 6010	1.0	0.5	0.5	543	<0.1	0
Cr Hexavalent via TCLP	1311 & 7197	<0.1	0.5	0.5	543	<0.1	1
Cu Total	6010	1500	31800	–	–	–	.
Cu via TCLP	1311 & 6010	5.0	10.0	10.0	543	<0.1	1
Permeability	ASTM D5084	–	–	$<1 \times 10^{-7}$ cm/sec	>300	All Passed	
Unconfined Compressive Strength	ASTM D2166	–	–	>15 psi at 5 days 100 psi at 28 days	>300	All Passed	

[a] Bates and Lau, 1993
[b] All methods per EPA 1995 (SW846) except ASTM
[c] Action level is the contaminant level in untreated soil, at or above which, treatment (action) is judged to be necessary.
[d] Treatment criteria is the targeted value to be achieved by treatment
[e] Total number of samples collected and analyzed.

The output from task 2 is a memo documenting the matrices to be evaluated with an understanding of the drivers for each matrix to help provide input for Section 2 of task 3 below. The memo will be reviewed by the WA-COR and OLEM colleagues to reach agreement on priorities to be pursued for task 3.

3. Background Information Document on Leaching of Organics. Using the report from the workshop on leaching of organics, the contractor shall prepare a report similar to the document prepared for inorganics (i.e., Background Information for the Leaching Environmental Assessment Framework (LEAF) Test

Methods, EPA-600/R-1-/170, December 2010). The contractor shall summarize into a background information document (BID) for organics to describe what is currently known about leaching of semi- and non-volatiles organics using information from the September 2015 workshop and documents referenced below. The BID will also identify bench scale work to narrow down the drivers for leaching that change based on the environmental conditions where waste or material is managed (e.g., liquid to solid ratio, pH, precipitation rate, and hydrology). The first output will be a draft outline and a schedule for completing sections for the document within this performance period and budget. The initial focus will be on the conceptual framework outlined below:

1. Introduction and Report Objectives
   - 1.1. Report Objectives
   - 1.2. Range of matrices and constituents of importance
   - 1.3. The need for leaching assessment tools for organic COPCs and potential regulatory uses (treatability studies amongst others)
   - 1.4. Summary review of case studies (summarizing 47 case studies referenced below to identify the priority wastes and treatment/remediation technologies)
2. Conceptual Models and Framework for Assessment of Leaching
   - 2.1. Conceptual models for COPCs in soils/sediments/wastes-aqueous-vapor systems - Phases and potential distribution of COPCs amongst phases, including processes and conditions that control the distribution and mass transfer rates (e.g., NAPLs, colloids, COPC properties, matrix properties)
     - 2.1.1. Identification of key drivers based on matrix and COPC properties
     - 2.1.2. Evaluation of sensitivities (this is where we would be using bounding calculations for liquid/solid partitioning equations and working with available empirical data)
   - 2.2. Understanding the effects of heterogeneity for in-situ treatment (the issue we discussed this morning on do we sample the goop of the additive mixed into the goop or range of mixtures of goop & additive)
   - 2.3. Conceptual framework for Leaching tests
     - 2.3.1. Use of empirical results for screening assessment and treatability studies
     - 2.3.2. Use of test results to parameterize more robust source terms (multi-phase mass transport; not geochemical speciation)
     - 2.3.3. Evaluation of sensitivities (this is where we would be using bounding calculations for liquid/solid partitioning equations and working with available empirical data)
   - 2.4. Understanding the effects of heterogeneity for in-situ treatment (the issue we discussed this morning on do we sample the goop of the additive mixed into the goop or range of mixtures of goop & additive)

Documents to review to summarize within the sections above are:

The output from task 3 will be the following:

Completion of 1st two sections containing information from task 2.
Outline for the entire BID
Identification of bench scale work and other lab work needed to narrow down drivers for each matrix type.

DELIVERABLES & SCHEDULE

Task 1 within 30 days of WP approval

Task 2 with 3 months of WP approval

Task 3 within 6 months of WP approval

ATTACHMENT #1 TO THE STATEMENT OF WORK (SOW)

FOR SECONDARY DATA PROJECTS

NRMRL Quality Assurance (QA) Requirements

In accordance with EPA Order 5360.1 A2, conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation specified herein. All quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approved the quality documentation. The quality documentation shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government. Any EPA-funded project/program may be subject to a QA audit.

TO BE SUBMITTED PRE-AWARD (mark all that apply):

☐ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,

http://www.epa.gov/quality/qs-docs/r2-final.pdf

TO BE SUBMITTED POST-AWARD (mark all that apply):

☐ **NRMRL's Quality System Specifications:**

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function; 07/14/08 A-2

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

☐ **Quality Management Plan:** prepared in accordance with R-2 - EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001,

http://www.epa.gov/quality/qs-docs/r2-final.pdf

☐ **Category I or II Quality Assurance Project Plan (QAPP):** prepared in accordance with R-5 - EPA Requirements for QA Project Plans (EPA/240/B-01/003) March, 2001 http://www.epa.gov/quality/qs-docs/r5-final.pdf

X **Category III or IV QAPP:** prepared in accordance with applicable sections of the following NRMRL QAPP Requirements List(s) which is(are) included in this attachment:

☐ **QAPP Requirements for Measurement Projects**

X **QAPP Requirements for Secondary Data Projects**

☐ **QAPP Requirements for Research Model Development and/or Application Projects**

☐ **QAPP Requirements for Software Development Projects**

☐ **QAPP Requirements for Method Development Projects**

☐ **QAPP Requirements for Design, Construction, and/or Operation of Environmental Technology Projects**

ADDITIONAL QA RESOURCES:

EPA's Quality System Website: http://www.epa.gov/quality/

EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

---

NRMRL QAPP REQUIREMENTS FOR SECONDARY DATA PROJECTS

GENERAL REQUIREMENTS

Include cover page, distribution list, approvals, and page numbers.

0. COVER PAGE

Include the Division/Branch, project title, revision number, EPA technical lead, QA category, organization responsible for QAPP preparation, and date.

1. PROJECT DESCRIPTION AND OBJECTIVES

1.1 Describe the process and/or environmental system to be evaluated.

1.2 State the purpose of the project and list specific project objective(s).

2. ORGANIZATION AND RESPONSIBILITIES

2.1 Identify all project personnel, including QA, and related responsibilities for each participating organization, as well as their relationship to other project participants.

2.2 Include a project schedule that includes key milestones.

3. SCIENTIFIC APPROACH

3.1 Identify the secondary data needed to meet the project objective(s). Specify requirements relating to the type of data, the age of data, geographical representation, temporal representation, and technological representation, as applicable.

3.2 Identify the source(s) for the secondary data. Discuss the rationale for selecting the source(s) identified. If a hierarchy of sources exists for the gathering of secondary data, specify that hierarchy.

4. QUALITY METRICS

4.1 Specify the quality requirements of the secondary data. These requirements must be appropriate for the intended use of the data. Address accuracy, precision, representativeness, completeness, and comparability, if applicable.

4.2 Describe the procedures for determining the quality of the secondary data.

4.3 If no project-specific data quality requirements exist, state this in the QAPP. If the quality of the secondary data will not be evaluated by EPA, require that a disclaimer be added to any project deliverable to indicate that the quality of the secondary data has not been evaluated by EPA for this specific application. Provide the wording for the disclaimer.

5. DATA ANALYSIS, INTERPRETATION, AND MANAGEMENT

5.1 Identify the data reporting requirements, including data reduction procedures specific to the project and applicable calculations and equations.

5.2 Describe data validation procedures used to ensure the reporting of accurate project data.

5.3 Describe how the data will be summarized or analyzed (e.g., qualitative analysis, descriptive or inferential statistics) to meet the project objective(s).

5.3.1- If descriptive statistics are proposed, state what tables, plots, and/or statistics (e.g., mean, median, standard error, minimum and maximum values) will be used to summarize the data.

5.3.2- If an inferential method is proposed, indicate whether the method will be a hypothesis test, confidence interval, or confidence limit and describe how the method will be performed.

5.4 Describe data storage requirements for both hard copy and electronic data.

6. REPORTING

6.1 List and describe the deliverables expected from each project participant.

6.2 Specify the expected final product(s) that will be prepared for the project (e.g., journal article, final report, etc.). Specify the source(s) of the secondary data in any deliverable.

7. REFERENCES

Provide references either in the body of the text as footnotes or in a separate section.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-042

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2016

Base Option Period Number 1

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 08/15/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Scott Moore
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-5104
FAX Number:

Project Officer Name Robin S. Harris
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0955
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Work Statement

WA Title: Metrology Laboratory ISO 17025 Accreditation

WA Short Title: ISO 17025 ACCR

WA #: 1-042 **WACOR:** Scott A. Moore

Contract #: EP-C-15-008 **ALT. WACOR:** Paul W. Groff

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement of Work (PWS) shall be from April 1, 2016 through March 31, 2017.

INTRODUCTION

Laboratories use International Standard Organization (ISO) 17025 to implement a quality system aimed at improving their ability to consistently produce valid results. It is also the basis for accreditation from an accreditation body. Since the standard is about competence, accreditation is simply formal recognition of a demonstration of that competence. A prerequisite for a laboratory to become accredited is to have a documented quality management system. The contents of the quality manual follow the outline of the ISO 17025 standard.

SUMMARY OF OBJECTIVES

The objective of this Work Assignment (WA) is to obtain ISO 17025 Accreditation for the APPCD Metrology Lab. The ISO 17025 Accreditation goes a step further than the commonly used NIST Traceability, in that there is a third party accreditation body that will evaluate Scope, Normative References, Terms and Definitions, Management Requirements and Technical Requirements of the Metrology Laboratory.

BACKGROUND

Lab Site: The APPCD Metrology Lab is located in rooms D360-A, D362 and D364-A in EPA's Research Center in Research Triangle Park, NC.

Justification: In a recent NHEERL Competency Audit two findings were revealed. One was that the pipette were not ISO 17025 Accredited. The other was that the Mass Weights were also not ISO 17025 Accredited. In order to meet these requirements it is necessary to acquire the ISO Accreditation for the Metrology Laboratory. Additionally the Metrology Laboratory will also be seeking accreditation for mass, gas flow, gas velocity, pressure, temperature, relative humidity, and ozone calibrations.

SCOPE

(1) The Met Lab was developed as a central means of providing the best practice for the calibration of laboratory equipment and at a low price by sharing those costs between various labs. The Contractor shall use their best practice in sharing the costs of equipment calibrations, repairs, system upgrades, purchases and labor hours evenly (based on volume of work) between all the WA issued pertaining to Metrology Support. The task of this work assignment may require electrical work, plumbing, general experience with lab equipment and materials, a familiarity with the calibration of measurement devices and a fundamental understanding of the principals behind the measurements. The contractor shall reduce data and report it according to the International Organization for Standardization (ISO) "General Requirements for the Competence of Calibration and Testing Laboratories" (ISO 17025) standard and the ISO "Guide to the Expression of Uncertainty in Measurement" (GUM).

(2) The Contractor shall obtain performance evaluation or GAP Analysis from a third party vendor. A GAP Analysis involves the comparison of actual performance with potential or desired performance.

(3) The Contractor shall report the finding of the GAP Analysis to the WACOR for further evaluation on how to proceed with the ISO Accreditation.

(4) The Contractor shall revise all MOPs/SOPs to conform to ISO Standards.

(5) The Contractor shall obtain ISO 17025 accreditation for mass, gas flow, gas velocity, pressure, temperature, relative humidity and ozone calibrations from an authorized accreditation body.

(6) The Contractor shall report the total number of hours and the total expenses incurred for all tasks, with each monthly invoice, in this Performance Work Statement (PWS).

(7) The Contractor shall perform company testing as prescribed by the ISO 17025 Accreditation body.

TECHNICAL APPROACH/OBJECTIVES

Task 1: ISO GAP Analysis of the Metrology Laboratory

The Contractor shall contact a third party vender to perform the GAP analysis for the Metrology Laboratory. Once the Gap Analysis has been performed the contractor can begin Tasks 2 and 3.

Task 2: Review and update all the MOPs /SOPs for ISO Accreditation.

The contractor, based on the findings from the Gap Analysis, shall edit the SOPs and MOPs to conform to ISO 17025 Accreditation.

Task 3: ISO 17025 Training

The Contractor shall acquire the proper training before the accreditation process begins. Third party venders should be used for either on-site training or via website.

Task 4: ISO 17025 Pre-Accreditation Audit

The Contractor shall obtain ISO 17025 pre-accreditation from a third party auditor for mass, gas flow, gas velocity, pressure, temperature, relative humidity and ozone calibrations from an authorized accreditation body.

Task 5: ISO 17025 Accreditation

The Contractor shall obtain ISO 17025 accreditation for mass, gas flow, gas velocity, pressure, temperature, relative humidity and ozone calibrations from an authorized accreditation body.

Task 6: ISO 17025 Post-Accreditation

The Contractor shall correct any of the findings during ISO 17025 Accreditation and report the corrective action to the WACOR and the authorized accreditation body. Once the accreditation for each of the measurements used in the Metrology Lab (mass, gas flow, gas velocity, pressure, temperature, relative humidity and ozone calibrations) the contractor shall use the ISO 17025 Accreditation Logo on all calibration reports.

WA SPECIFIC EQUIPMENT

Any equipment used in the Met Lab is shared among different work assignments and no equipment is specific to this work assignment.

QUALITY ASSURANCE

Quality Assurance will be based on the accreditation bodies report. The contractor shall make these reports available to the WACOR as soon as they are received.

DELIVERABLES

The Contractor shall provide the following reports:

(1) Monthly reports of the accreditation activities including the following:

a) Schedule of the ISO 17025 GAP Analysis
b) Any costs incurred during Accreditation process
c) Final report of the GAP Analysis

d) Any training acquired for accreditation
e) Status of the SOPs or MOPs to meet accreditation requirements
f) Monthly reports of progress made with the Accreditation.

(2) Special reports as requested via a Technical Directive by the WACOR.

(3) The Contractor shall respond to all calibration needs however priority shall be given to projects that have time constraints. The WACOR shall be notified if any calibration cannot be completed on time.

(4) The WACOR shall be copied on all correspondence to and from any laboratories and venders used in the completion of the tasks associated with the projects. Any documents or literature during any of these correspondences will also be made available to the WACOR.

(5) The Contractor shall provide a Calibration Certificate for each device and give it to the Principle Investigator (PI) or to the Contractor Task Lead and keep a copy (either hard copy or electronic) on record.

(6) Formatting of reports shall be consistent with historical reporting and electronic files shall be compatible with Agency Standard Software. During EPA Fiscal Year 2016 (FY16) federal employees and Contractors will be using Windows 7 Enterprise, Adobe Reader 11 and Microsoft Office 2013. Any upgrades will be announce by OEI. Hard copies of reports are acceptable; however, electronic copies are encouraged.

SHEDULE OF DELIVERABLES

Each calibration report will be considered a deliverable. The Contractor shall provide all deliverables within 14 days after completing a calibration. Monthly reports shall be due at the same time the contractor invoiced EPA. Rough schedule as follows:

2016 - GAP Analysis
2016/2017 – MOP and SOP Review
2016/2017 – ISO Training
2017 – Pre-Accreditation Preparation
2017 – Accreditation
2017 – Post Accreditation

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-059

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Worth Calfee
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7600
FAX Number: 919-541-0496

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

PERFORMANCE WORK STATEMENT

ASSESSMENT OF RAIN, WATER WASH-DOWN, AND GROSS DECONTAMINATION METHODS FOR REDUCTION, REMOVAL, OR INACTIVATION OF SPORES ON URBAN SURFACES

PROJECT# HS 8.51.02-335

WORK ASSIGNMENT 1-059

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HOMELAND SECURITY RESEARCH CENTER
DECONTAMINATION AND CONSEQUENCE MANAGEMENT DIVISION

I. PERIOD OF PERFORMANCE 2
II. SUMMARY OF OBJECTIVES 2
III. RELEVANCE 2
IV. BACKGROUND 2
V. SCOPE 3
VI. TECHNICAL APPROACH 4
VII. AFFORDABILITY 4
VIII. TECHNICAL RISK 5
IX. FACILITIES AND MATERIALS 5
X. TASKS 5
XI. DELIVERABLE SCHEDULE 9
XII. REPORTING REQUIREMENTS 9

TITLE

Assessment of Rain, Water Wash-Down, and Gross Decontamination Methods for Reduction, Removal, or Inactivation of Spores on Urban Surfaces.

I. PERIOD OF PERFORMANCE

The period of performance for the work under this work assignment shall be April 1, 2016 through March 31, 2017.

II. SUMMARY OF OBJECTIVES

This work shall determine the effectiveness of spore removal from surfaces by various liquid application procedures. Application procedures shall model rain (various kinetic energies), wash-down as a mitigative measure, and other gross-decon approaches that utilize liquids sprayed onto surfaces to reduce contaminants and exposure. Parameters such as wash down liquid, additives, pressure, flow rate, material type, and spray duration shall be evaluated for their ability to physically remove spores from surfaces. The collateral damage to materials during decontamination procedures will be monitored. These data will inform spore removal and transport in an urban environment during a wide area incident and response.

III. RELEVANCE

This project supports the mission of the Decontamination and Consequence Management Division (DCMD) within the U.S. Environmental Protection Agency's (U.S. EPA) National Homeland Security Research Center (NHSRC) by providing relevant information pertinent to the decontamination of contaminated areas resulting from an act of terrorism. The project supports the EPA's Homeland Security Research Program (HSRP) and the NHSRC's strategic goals as described in detail in the Homeland Security Research Multi-year Strategic Plan (draft, November 26, 2008). Specifically, the project is relevant to Long-Term Goal 2 (LTG-2) which states, "The Office of Solid Waste and Emergency Response (OSWER) and other clients use homeland security research program products and expertise to improve the capability to respond to terrorist attacks affecting buildings and the outdoor environments." This project addresses a direct need expressed by OSWER's CBRN Consequence Management Advisory Division (CMAT), regarding an understanding of Fate and Transport of Contaminants in a Wide Area Incident, and regarding the effectiveness of Gross Decontamination (Wash Down) Procedures for spore removal. Due to the potential relevance of this project in preparing for the Federal response to wide-area anthrax incidents, this project will be managed by NHSRC with the support of a multidiscipline project team.

IV. BACKGROUND

Under Homeland Security Presidential Directive (HSPD)-10, the U.S. Department of Homeland Security (DHS) is tasked to coordinate with other appropriate Federal departments and agencies, to develop comprehensive plans which, "provide for seamless, coordinated Federal, state, local, and international responses to a biological attack." As part of these plans, the U.S. EPA, in a coordinated effort with DHS, is responsible for "developing strategies, guidelines, and plans for decontamination of persons, equipment, and facilities" to mitigate the risks of contamination following a biological weapons attack.

NHSRC provides expertise and products that can be widely used to prevent, prepare for, and recover from public health and environmental emergencies arising from terrorist threats and incidents. Within NHSRC, DCMD's decontamination research program's goal is to provide expertise and guidance on the selection and implementation of decontamination methods and provide the scientific basis for a significant reduction in the time and cost of decontamination events. The NHSRC's research supports OSWER and OPP. OSWER, through its Special Teams which includes the CBRN CMAT, supports the emergency response functions carried out by the Regional Offices. OPP supports the decontamination effort by providing expertise on biological agent inactivation and ensuring that the use of pesticides in such efforts is done in accordance with FIFRA. Close collaboration between the different program offices having homeland security responsibilities is sought in order to rapidly increase the U.S. EPA's capabilities to help the Nation recover from a terrorist event involving the intentional release of CBR materials. Such collaborations are fostered through efforts such as PARTNER.

In 2001, the introduction of a few letters containing anthrax spores into the U.S. Postal Service system resulted in the contamination of several facilities. Although most of the facilities in which these letters were processed or received in 2001 were heavily-contaminated, they were successfully remediated with approaches such as fumigation with chlorine dioxide or VHP®. It is well agreed that additional quick, effective and economical decontamination methods having the capacity to be employed over wide areas (outdoor and indoor) are required to increase preparedness for such a release.

Following a wide-area contamination incident, it has been generally accepted that responders and remediation workers will use wash-down methods to reduce the amount of residual contamination on buildings, streets, and objects (cars, park benches, vegetation, etc.). These procedures are expected to reduce the amount of contamination spread (via aerosol) to non-contaminated areas, and reduce the risk of exposure to emergency personnel and civilians after reoccupation. Currently, there are few data that describe the effectiveness of such wash-down procedures. A systematic evaluation of such wash-down methods, and identification of parameters for optimizing the effectiveness of these approaches is needed.

Numerous factors can influence spore transport in the urban environment following an incident. Redistribution of spores by rain and stormwater runoff is expected in the days following a release. Data on the effectiveness of spore removal from surfaces under typical precipitation conditions are not well known. These data are critical for determining the fate of contaminants in an urban setting.

V. SCOPE

The purpose of this project is to determine the effectiveness of wash-down gross decontamination methods, rain, and overland flows (urban runoff) for removing spores from surfaces. These objectives shall be accomplished through Seven Tasks.

In Task 1, develop a QAPP.

In Task 2, properties of urban materials shall be characterized under water conditions typical of rain, overland flow, and decontamination approaches. Representative samples of concrete, brick, and asphalt shall be analyzed for porosity, water sorption, zeta potential, and contact angle.

In Task 3, advanced testing of the rainwater simulator shall be conducted. This shall include detailed analysis of rain rate, rain droplet size, droplet settling velocity, and spray pattern across the simulator's range of operation (flows, nozzle height, and nozzle configuration).

In Task 4, spore removal from surfaces by overland flows shall be determined. A test bed shall be devised whereby repeatable amounts of contaminants are added to either coupons or flow waters, coupons of repeatable characteristics are constructed and tested, flows of various durations and rates (volume per time) are administered, and repeatable and consistent runoff sample collection will be executed. Spore recoveries in runoff waters shall be measured to characterize the effects of the controlled variables on overland flow spore removal efficiency.

In Task 5, spore removal from surfaces shall be evaluated for simulated rain events. Rain, of varying kinetic energies (through different combinations of droplet size, intensity, and duration) shall be modeled in the laboratory. Contaminated coupons (aerosol deposited or liquid deposited), shall be subjected to the simulated rain. Runoff samples shall be collected at various intervals to determine the magnitude and temporal characteristics of spore removal.

In Task 6, tests shall be conducted to determine the effect of varying spray parameters (i.e., flow rate, pressure, liquid chemistry, angle etc.), on spore removal during mitigation strategies. The amount of spores in both the runoff and aerosol fractions shall be determined.

In Task 7, the effects of concrete on spore viability shall be determined. These data are important, as concrete has a high pH, and may reduce the viability over time, and can therefore impact the modeling of spore fate and transport in an urban environment.

The results of all tasks shall be documented in one final report discussing removal as a function of independent variables and operational factors associated with each removal method. A draft report shall be provided to the U.S. EPA Work Assignment Manager (EPA WAM) for review and comment. A final report incorporating comments from the EPA WAM, and including a separate documentation of the disposition of comments, shall also be provided as the final deliverable on this work assignment. All products developed under this SOW (e.g., the above mentioned technical report) must conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

VI. TECHNICAL APPROACH

The general approach that shall be used to meet the objectives of this project for both tasks is as follows, as briefly mentioned in the Section VI:

- inoculation of the materials with *Bacillus atrophaeus* (formerly, *Bacillus globigii*) spores via aerosol deposition using the procedures developed by Calfee et al., Journal of Microbiological Methods 2013(92375-380),
- application of prescribed flow methods or wash-down procedures;
- assessment of viable spores in runoff liquids, in starting inoculation (via sampling of inoculation control coupons), and potential cross-contamination (via sampling of negative controls [blanks]);

All sample analysis is outside of the scope of this work assignment. Samples shall be transferred to the on-site Microbiology Lab for analysis under a separate work assignment.

VII. AFFORDABILITY

Components of this study are expected to be somewhat labor intensive; the decontamination processes, sampling, and laboratory assays will require extensive human resources. Relative to the labor costs, only a minimal amount of expendable materials and material characterization are required to be purchased by the contractor for use in this effort.

VIII. TECHNICAL RISK

The technical risk involved in this project is thought to be minimal. The purpose of the effort is to provide information pertinent to the development of operational strategies for the decontamination methods included in the study. Hence, all information obtained in this project (whether intended or not) is expected to be significantly relevant to this purpose.

IX. FACILITIES AND MATERIALS

All work on this project described in this performance work statement (PWS) shall be performed at the U.S. EPA's facilities located at 109 T.W. Alexander Dr., Research Triangle Park, NC. This study shall be conducted in H122A and/or H130A.

X. TASKS

Prior to initiation of the testing described in the tasks below, a quality assurance project plan (QAPP) or amendment to existing QAPPs shall be provided to EPA for review and comment. After revision based upon EPA comments (as necessary) and approval by EPA, work may commence. At least eight Applied Research QAPPs have been approved by the U.S. EPA for prior testing that have relevance to this effort (QAPPs can be provided to contractor after initiation of Work Assignment):

- Assessment of Liquid and Physical Decontamination Methods for Environmental Surfaces Contaminated with Bacterial Spores: Part 1 – Development and Evaluation of the Decontamination Procedural Steps (July 2009)
- Assessment of Liquid and Physical Decontamination Methods for Environmental Surfaces Contaminated with Bacterial Spores: Part 2 – Operational-scale Study of Full Decontamination Procedures (October 2009)
- Application Studies of Biological Agent Decontamination Methods (April 2008)
- Effectiveness of Physical and Chemical Cleaning and Disinfection Methods for Removing, Reducing or Inactivating Agricultural Biological Threat Agents (August 2010)
- Assessment of Liquid and Physical Decontamination Methods for Environmental Surfaces Contaminated with Bacterial Spores: Part 4 – Optimization of method parameters and impact of surface grime (June 2011).
- Assessment of Water Wash Down for Mitigation of Cesium Chloride Contamination PART II Pressure Washing
- Penetration of Radiological Dispersal Device (RDD) Material (CsCl and CoCl2) on Urban Building Surfaces: Effects of Serial Water Washdown

- Optimization of Water Wash down Using Simulated Firehose for RDD Decontamination

These QAPPs shall be used as the basis for the QAPP for the specific work described in this SOW. The QAPP, including any amendments, must be approved by the U.S. EPA in writing (e.g., signature on the approval page) prior to the start of any work. Additional information related to QA requirements can be found at: http://www.epa.gov/quality/qs-docs/r5-final.pdf.

All test activities shall be fully documented during the activity via narratives in laboratory journals, the use of digital photography and video, and data provided in excel spreadsheets. This information shall be incorporated into the final report, as warranted to document and convey the findings of this effort. The documentation should include, but not be limited to, record of time required for each decontamination step or procedure, visual observations during the procedures, any deviations from the test plans, physical impacts on the materials, and impacts on the decontamination or sampling personnel.

The technical approach to be used throughout this study shall be developed considering the background information provided in Section V and this section. This study shall be done in seven major tasks. The specific details related to these tasks are described in the following pages.

Task 1:

Preparation of the Quality Assurance Project Plan (QAPP)

The contractor shall prepare a QAPP in accordance with Quality Assurance (QA) Category B. Attachment 1 to the PWS provides information regarding **NHSRC QA Requirements/Definitions List.**

QAPPs prepared for a Category B (formerly known as a Category 3 or 4) project must be developed in accordance with the document titled "EPA Requirements for Quality Assurance Project Plans." EPA QA/R-5 can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf and must be approved by an EPA Quality Assurance Manager (QAM) prior to the start of any literature searches (existing data), data collection, gathering, synthesizing, or data generation (laboratory) work.

Task 2:

Urban Material Characterization

Extended materials characterization of the urban surfaces and surrogate spores used in this project under varying water quality conditions shall be collected. Table 1 summarizes the test

conditions and analytical techniques for material characterization that shall be used.

Table 1: Task 2 Test Variables

Materials	Characterization Technique	Conditions
Red brick Concrete Concrete pavers Asphalt	Mercury Intrusion Porosimetry (MIP)	• ISO 15901 • 1 hr outgassing at 105 ± 3 ° C
	Water Adsorption	• Gravimetric method at 22 ± 3 ° C • 1 hr. outgassing at 105 ± 3 ° C • Adsorption and desorption points for varied relative humidity
	Zeta Potential Curves	• Streaming potential measurements from pH 3-10 for solid surfaces • 5 water quality recipes
	Contact Angle	• Liquids: deionized water, glycerol, 1-bromonapthalene • # measurement locations per coupon: ≥ 3 • # replicates/location: ≥ 5
B. *atrophaeus [9372]* Btk	Zeta Potential Curves	• Streaming potential measurements from pH 3-10 for particles • pH ~ 5.5 • Ionic strength 1-300 mM as KCl (minimum 10 ionic strengths)
	Contact Angle	• Spore lawns according to Brown and Jaffé (2006) • Location, liquids, and replicates same as above

Task 3:

Rainwater Simulator Performance Testing

Any rainwater simulator(s) used during the course of this project shall be characterized according to the following parameters: rain rate (at max and min operating pressure), spray pattern, wetted coupon area, droplet size distribution (at nozzle and at height of impact on the coupon), and droplet velocity. Five tests for each individual nozzle and multiple nozzles (in manifold) combinations shall be performed to characterize the rain that is being simulated for use in Task 5.

Task 4:

Evaluation of Overland Flow for Spore Removal from Surfaces

In this task, various flows of water shall be evaluated for spore removal from urban surface materials. Contamination starting condition shall be varied, such that dry aerosols, wet inoculums, and contaminants residing only in flow waters (not on coupons initially, but flowed over material coupons to determine losses to the surfaces) will be evaluated. Flow rate and slope shall also be varied. These evaluations shall occur over a minimum of 36 tests (each material-deposition combination at 2 flowrates and 2 slopes) for which washoff of spores is documented as evenly spaced samples from time of peak contamination release to steady state removal. A sufficient number of test and control replicates shall be included in the test matrix. Test variables are outlined in Table 2.

Table 2: Task 4 Test Variables

Tests	Materials	Flow Variables	Contamination Variable
1-36	Red brick Concrete Asphalt	Rate, Slope	Aerosol Deposition onto Dry Coupon, Wet Deposition onto Dry Coupon, Spores residing in Flow Water, *Bacillus atrophaeus* versus *Bacillus thuringiensis*

Task 5:

Determination of Spore Removal from Surfaces by Simulated Rain

In Task 5, at least 24 tests shall be conducted to determine the effectiveness of spore removal by simulated rainfall using the nozzles from Task 3 on red brick, concrete, and asphalt. Varying intensities of rain shall be evaluated for spore removal from surfaces.

Table 3: Task 5 Test Variables

Tests	Materials	Rain Variables	Contamination Variable
1-24	Red brick Concrete Asphalt	Rate (inch/hour)	Aerosol Deposition onto Dry Coupon, Wet Deposition onto Dry Coupon

Task 6:

Evaluation of washdown approaches for physical removal of surface biological contamination

In Task 6, at least 16 tests shall be conducted to determine the effectiveness of wash-down procedures on sections of selected outdoor material types (i.e., concrete, glass, etc.). Spray parameters such as nozzle type, flow rate, application duration, additives, and spray pattern (wash down from above on vertical surfaces versus perpendicular spray-down for vertical surfaces) shall be evaluated. In addition to determining surface removal effectiveness (by determining spore relocation into runoff liquid and aerosolization) shall be determined.

Test variables for Task 6 are outlined in Table 4.

Table 4: Task 6 Test Variables

Tests	Materials	Flow Variables	Contamination Variable
1-16	Concrete (horizontal), Glass (vertical),	Orientation (from above, from side), Pressure (up to fire hose or pressure washer), Rate, Duration, spray pattern	Aerosol Deposition onto Dry Coupon, Wet Deposition onto Dry Coupon

Task 7:

Determination of spore survival in saturated and unsaturated concrete and asphalt matrices

In Task 7, two approaches will be utilized to determine spore survival in common urban porous surface types (i.e., concrete and asphalt). Survival will be determined under saturated (covered in water) and unsaturated (dry) conditions. The two approached shall include (1) inoculation of small material coupons with spores, subjecting these coupons to saturated or unsaturated conditions for a duration of time (i.e., 1 month) and determining spore survival at 6 non-zero time points; or (2) mixing pulverized concrete or asphalt with spore inoculums, and determining

survival over time under saturated and unsaturated conditions. These data will aid in predicting spore fate and transport in a wide-area urban incident.

Additional Test Requirements:

- Wash-down liquids shall be confirmed to be free of confounding levels of background contamination prior to the initiation of each test.

- Air samples shall be taken in the decontamination chamber during the wash-down process to indicate the presence of resuspended viable spores. These samples shall be collected in accordance with the air sampling described in the approved QAPP entitled, Assessment of Liquid and Physical Decontamination Methods for Environmental Surfaces Contaminated with Bacterial Spores: Part 2 – Operational-scale Study of Full Decontamination Procedures (October 2009)."

- After completion of each test, the chamber and all contents shall be thoroughly decontaminated with a proven procedure.

- All samples shall be transferred to the on-site Microbiology Lab in sterile primary independent packaging within sterile secondary containment containing logical groups of samples. All samples shall be accompanied by a completed chain of custody form.

- All microbiological analysis for samples described in this SOW shall be performed by the on-site Microbiology Lab. This analysis is outside of the scope of this SOW.

- All tests shall be extensively and adequately photographed and video documented to convey the test procedures.

Reporting

The contractor shall design an MS Excel data reporting sheet template prior to the start of any work that conveys all relevant information from a test under Task 1 and 2. This template shall be approved by the EPA for use, prior to conducting any testing described in this SOW. All photographs and videos shall be properly documented, indicating the exact tests in which they were taken. A log (in MS Excel) of all photographs and videos shall be maintained with the electronic files. The log shall include a description of each photograph and video, and include the test number and date. All electronic files shall be stored in a project folder set up on the EPA's DTRL share drive. All information relevant to a test (reporting sheet, digital photographs, videos, log file) shall be transmitted to the EPA WAM within 1 week from the completion of the sample analysis. This data shall have been QA/QC'd by the contractor prior to transmission. Transmission shall occur via e-mail to the EPA WAM informing him/her that the data is ready for viewing.

A draft report detailing the test results and lessons learned from the testing shall be submitted to the EPA WAM within 30 days following the completion of the testing and no later than 2/10/2017. This report shall include documentation of the time required to complete each entire test procedure

and all procedural steps. The report shall include any digital photos necessary to illustrate the findings. The draft report shall be submitted by the EPA WAM for review from within EPA, including a Quality Assurance review. A final report incorporating requested changes, correction, and clarification resulting from the review process shall be submitted by the contractor within 15 days from receiving the official comments from the EPA WAM. A separate document detailing the response to comments shall also be submitted to the EPA WAM by the contractor with the final version of the report. The Final Report shall be delivered no later than 3/20/2017.

XI. DELIVERABLE SCHEDULE

The deliverables previously described in this SOW with the scheduled due date are shown in Table 5.

Table 5: Deliverable Schedule

Deliverable	Due Date
QAPP amendment (if required)	15 working days after initiation of this Work Assignment
Draft Report	2/10/2017
Final Report	3/20/2017

XII. REPORTING REQUIREMENTS

- The monthly invoice reports for this work assignment shall provide a detailed description of any equipment or expendables that have been purchased by the contractor for use on the projects discussed herein.
- All data related to this project shall be stored on the U.S. EPA servers in the DTRL share folder.
- Data transfer to the EPA WAM shall occur within one week from the completion of data analysis.
- In lieu of final reports for each or any task, journal papers within each task may be submitted at the discretion of the EPA WAM. The papers shall be authored or co-authored by the EPA WAM, at the discretion of the WAM. To serve in lieu of the final report, the journal articles must contain all of the relevant information that would have appeared in the final report.
- All products developed under this SOW (e.g., the above mentioned technical report) must conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-059

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2016
Base Option Period Number 1

Title of Work Assignment/SF Site Name: 1-059 Amd 1

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Worth Calfee	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-7600
			FAX Number: 919-541-0496
Project Officer Name Robin S. Harris	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-0955
			FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code:
			Phone Number:
			FAX Number:
Contracting Official Name Mark Cranley	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-487-2351
			FAX Number: 513-487-2109

PERFORMANCE WORK STATEMENT

ASSESSMENT OF RAIN, WATER WASH-DOWN, AND GROSS DECONTAMINATION METHODS FOR REDUCTION, REMOVAL, OR INACTIVATION OF SPORES ON URBAN SURFACES

PROJECT# HS 8.51.02-335

WORK ASSIGNMENT 1-059

AMENDMENT 1

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HOMELAND SECURITY RESEARCH CENTER
DECONTAMINATION AND CONSEQUENCE MANAGEMENT DIVISION

I. PERIOD OF PERFORMANCE 2
II. SUMMARY OF OBJECTIVES 2
III. RELEVANCE 2
IV. BACKGROUND 2
V. SCOPE 3
VI. TECHNICAL APPROACH 4
VII. AFFORDABILITY 4
VIII. TECHNICAL RISK 5
IX. FACILITIES AND MATERIALS 5
X. TASKS 5
XI. DELIVERABLE SCHEDULE 9
XII. REPORTING REQUIREMENTS 9

TITLE
Assessment of Rain, Water Wash-Down, and Gross Decontamination Methods for Reduction, Removal, or Inactivation of Spores on Urban Surfaces.

I. PERIOD OF PERFORMANCE
The period of performance for the work under this work assignment shall be April 1, 2016 through March 31, 2017.

II. SUMMARY OF OBJECTIVES
This work shall determine the effectiveness of spore removal from surfaces by various liquid application procedures. Application procedures shall model rain (various kinetic energies), wash-down as a mitigative measure, and other gross-decon approaches that utilize liquids sprayed onto surfaces to reduce contaminants and exposure. Parameters such as wash down liquid, additives, pressure, flow rate, material type, and spray duration shall be evaluated for their ability to physically remove spores from surfaces. The collateral damage to materials during decontamination procedures will be monitored. These data will inform spore removal and transport in an urban environment during a wide area incident and response.

III. RELEVANCE
This project supports the mission of the Decontamination and Consequence Management Division (DCMD) within the U.S. Environmental Protection Agency's (U.S. EPA) National Homeland Security Research Center (NHSRC) by providing relevant information pertinent to the decontamination of contaminated areas resulting from an act of terrorism. The project supports the EPA's Homeland Security Research Program (HSRP) and the NHSRC's strategic goals as described in detail in the Homeland Security Research Multi-year Strategic Plan (draft, November 26, 2008). Specifically, the project is relevant to Long-Term Goal 2 (LTG-2) which states, "The Office of Solid Waste and Emergency Response (OSWER) and other clients use homeland security research program products and expertise to improve the capability to respond to terrorist attacks affecting buildings and the outdoor environments." This project addresses a direct need expressed by OSWER's CBRN Consequence Management Advisory Division (CMAT), regarding an understanding of Fate and Transport of Contaminants in a Wide Area Incident, and regarding the effectiveness of Gross Decontamination (Wash Down) Procedures for spore removal. Due to the potential relevance of this project in preparing for the Federal response to wide-area anthrax incidents, this project will be managed by NHSRC with the support of a multidiscipline project team.

IV. BACKGROUND
Under Homeland Security Presidential Directive (HSPD)-10, the U.S. Department of Homeland Security (DHS) is tasked to coordinate with other appropriate Federal departments and agencies, to develop comprehensive plans which, "provide for seamless, coordinated Federal, state, local, and international responses to a biological attack." As part of these plans, the U.S. EPA, in a coordinated effort with DHS, is responsible for "developing strategies, guidelines, and plans for decontamination of persons, equipment, and facilities" to mitigate the risks of contamination following a biological weapons attack.

NHSRC provides expertise and products that can be widely used to prevent, prepare for, and recover from public health and environmental emergencies arising from terrorist threats and incidents. Within NHSRC, DCMD's decontamination research program's goal is to provide expertise and guidance on the selection and implementation of decontamination methods and provide the scientific basis for a significant reduction in the time and cost of decontamination events. The NHSRC's research supports OSWER and OPP. OSWER, through its Special Teams which includes the CBRN CMAT, supports the emergency response functions carried out by the Regional Offices. OPP supports the decontamination effort by providing expertise on biological agent inactivation and ensuring that the use of pesticides in such efforts is done in accordance with FIFRA. Close collaboration between the different program offices having homeland security responsibilities is sought in order to rapidly increase the U.S. EPA's capabilities to help the Nation recover from a terrorist event involving the intentional release of CBR materials. Such collaborations are fostered through efforts such as PARTNER.

In 2001, the introduction of a few letters containing anthrax spores into the U.S. Postal Service system resulted in the contamination of several facilities. Although most of the facilities in which these letters were processed or received in 2001 were heavily-contaminated, they were successfully remediated with approaches such as fumigation with chlorine dioxide or VHP®. It is well agreed that additional quick, effective and economical decontamination methods having the capacity to be employed over wide areas (outdoor and indoor) are required to increase preparedness for such a release.

Following a wide-area contamination incident, it has been generally accepted that responders and remediation workers will use wash-down methods to reduce the amount of residual contamination on buildings, streets, and objects (cars, park benches, vegetation, etc.). These procedures are expected to reduce the amount of contamination spread (via aerosol) to non-contaminated areas, and reduce the risk of exposure to emergency personnel and civilians after reoccupation. Currently, there are few data that describe the effectiveness of such wash-down procedures. A systematic evaluation of such wash-down methods, and identification of parameters for optimizing the effectiveness of these approaches is needed.

Numerous factors can influence spore transport in the urban environment following an incident. Redistribution of spores by rain and stormwater runoff is expected in the days following a release. Data on the effectiveness of spore removal from surfaces under typical precipitation conditions are not well known. These data are critical for determining the fate of contaminants in an urban setting.

V. SCOPE

The purpose of this project is to determine the effectiveness of wash-down gross decontamination methods, rain, and overland flows (urban runoff) for removing spores from surfaces. These objectives shall be accomplished through ~~Seven~~ Eight Tasks.

In Task 1, develop a QAPP.

In Task 2, properties of urban materials shall be characterized under water conditions typical of rain, overland flow, and decontamination approaches. Representative samples of concrete, brick, and asphalt shall be analyzed for porosity, water sorption, zeta potential, and contact angle.

In Task 3, advanced testing of the rainwater simulator shall be conducted. This shall include detailed analysis of rain rate, rain droplet size, droplet settling velocity, and spray pattern across the simulator's range of operation (flows, nozzle height, and nozzle configuration).

In Task 4, spore removal from surfaces by overland flows shall be determined. A test bed shall be devised whereby repeatable amounts of contaminants are added to either coupons or flow waters, coupons of repeatable characteristics are constructed and tested, flows of various durations and rates (volume per time) are administered, and repeatable and consistent runoff sample collection will be executed. Spore recoveries in runoff waters shall be measured to characterize the effects of the controlled variables on overland flow spore removal efficiency.

In Task 5, spore removal from surfaces shall be evaluated for simulated rain events. Rain, of varying kinetic energies (through different combinations of droplet size, intensity, and duration) shall be modeled in the laboratory. Contaminated coupons (aerosol deposited or liquid deposited), shall be subjected to the simulated rain. Runoff samples shall be collected at various intervals to determine the magnitude and temporal characteristics of spore removal.

In Task 6, tests shall be conducted to determine the effect of varying spray parameters (i.e., flow rate, pressure, liquid chemistry, angle etc.), on spore removal during mitigation strategies. The amount of spores in both the runoff and aerosol fractions shall be determined.

In Task 7, the effects of concrete on spore viability shall be determined. These data are important, as concrete has a high pH, and may reduce the viability over time, and can therefore impact the modeling of spore fate and transport in an urban environment.

In Task 8, the effects in Task 7 (concrete on spore viability) shall be further characterized. More specifically, the competing effects of reductions is sample collection efficiency and reduced spore viability (which both contribute to lower recoveries of viable spores) shall be determined. The use of Coulter Counter to determine total particles recovered from inoculums and extract samples from concrete over several timepoints shall be compared to CFU (determined by culture). These methods shall be used to distinguish between 4 fractions; (1) viable and recoverable, (2) non-viable and recoverable, (3) viable and non-recoverable, and (4) non-viable and non-recoverable. The effort is expected to generate ~750 samples for analysis.

The results of all tasks shall be documented in one final report discussing removal as a function of independent variables and operational factors associated with each removal method. A draft report shall be provided to the U.S. EPA Work Assignment Manager (EPA WAM) for review and comment. A final report incorporating comments from the EPA WAM, and including a separate documentation of the disposition of comments, shall also be provided as the final deliverable on this work assignment. All products developed under this SOW (e.g., the above mentioned technical report) must conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

VI. TECHNICAL APPROACH

The general approach that shall be used to meet the objectives of this project for both tasks is as follows, as briefly mentioned in the Section VI:

- inoculation of the materials with *Bacillus atrophaeus* (formerly, *Bacillus globigii*) spores via aerosol deposition using the procedures developed by Calfee et al., Journal of Microbiological Methods 2013(92375-380),
- application of prescribed flow methods or wash-down procedures;
- assessment of viable spores in runoff liquids, in starting inoculation (via sampling of inoculation control coupons), and potential cross-contamination (via sampling of negative controls [blanks]);

All sample analysis is outside of the scope of this work assignment. Samples shall be transferred to the on-site Microbiology Lab for analysis under a separate work assignment.

VII. AFFORDABILITY

Components of this study are expected to be somewhat labor intensive; the decontamination processes, sampling, and laboratory assays will require extensive human resources. Relative to the labor costs, only a minimal amount of expendable materials and material characterization are required to be purchased by the contractor for use in this effort.

VIII. TECHNICAL RISK

The technical risk involved in this project is thought to be minimal. The purpose of the effort is to provide information pertinent to the development of operational strategies for the decontamination methods included in the study. Hence, all information obtained in this project (whether intended or not) is expected to be significantly relevant to this purpose.

IX. FACILITIES AND MATERIALS

All work on this project described in this performance work statement (PWS) shall be performed at the U.S. EPA's facilities located at 109 T.W. Alexander Dr., Research Triangle Park, NC. This study shall be conducted in H122A and/or H130A.

X. TASKS

Prior to initiation of the testing described in the tasks below, a quality assurance project plan (QAPP) or amendment to existing QAPPs shall be provided to EPA for review and comment. After revision based upon EPA comments (as necessary) and approval by EPA, work may commence. At least eight Applied Research QAPPs have been approved by the U.S. EPA for prior testing that have relevance to this effort (QAPPs can be provided to contractor after initiation of Work Assignment):

- Assessment of Liquid and Physical Decontamination Methods for Environmental Surfaces Contaminated with Bacterial Spores: Part 1 – Development and Evaluation of the Decontamination Procedural Steps (July 2009)
- Assessment of Liquid and Physical Decontamination Methods for Environmental Surfaces Contaminated with Bacterial Spores: Part 2 – Operational-scale Study of Full Decontamination Procedures (October 2009)
- Application Studies of Biological Agent Decontamination Methods (April 2008)

- Effectiveness of Physical and Chemical Cleaning and Disinfection Methods for Removing, Reducing or Inactivating Agricultural Biological Threat Agents (August 2010)
- Assessment of Liquid and Physical Decontamination Methods for Environmental Surfaces Contaminated with Bacterial Spores: Part 4 – Optimization of method parameters and impact of surface grime (June 2011).
- Assessment of Water Wash Down for Mitigation of Cesium Chloride Contamination PART II Pressure Washing
- Penetration of Radiological Dispersal Device (RDD) Material (CsCl and CoCl2) on Urban Building Surfaces: Effects of Serial Water Washdown
- Optimization of Water Wash down Using Simulated Firehose for RDD Decontamination

These QAPPs shall be used as the basis for the QAPP for the specific work described in this SOW. The QAPP, including any amendments, must be approved by the U.S. EPA in writing (e.g., signature on the approval page) prior to the start of any work. Additional information related to QA requirements can be found at: http://www.epa.gov/quality/qs-docs/r5-final.pdf.

All test activities shall be fully documented during the activity via narratives in laboratory journals, the use of digital photography and video, and data provided in excel spreadsheets. This information shall be incorporated into the final report, as warranted to document and convey the findings of this effort. The documentation should include, but not be limited to, record of time required for each decontamination step or procedure, visual observations during the procedures, any deviations from the test plans, physical impacts on the materials, and impacts on the decontamination or sampling personnel.

The technical approach to be used throughout this study shall be developed considering the background information provided in Section V and this section. This study shall be done in seven major tasks. The specific details related to these tasks are described in the following pages.

Task 1:

Preparation of the Quality Assurance Project Plan (QAPP)

The contractor shall prepare a QAPP in accordance with Quality Assurance (QA) Category B. Attachment 1 to the PWS provides information regarding **NHSRC QA Requirements/Definitions List.**

QAPPs prepared for a Category B (formerly known as a Category 3 or 4) project must be developed in accordance with the document titled "EPA Requirements for Quality Assurance Project Plans." EPA QA/R-5 can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf and must be approved by an EPA Quality Assurance Manager (QAM) prior to the start of any literature searches (existing data), data collection, gathering, synthesizing, or data generation (laboratory) work.

Task 2:

Urban Material Characterization

Extended materials characterization of the urban surfaces and surrogate spores used in this project under varying water quality conditions shall be collected. Table 1 summarizes the test conditions and analytical techniques for material characterization that shall be used.

Table 1: Task 2 Test Variables

Materials	Characterization Technique	Conditions
Red brick Concrete Concrete pavers Asphalt	Mercury Intrusion Porosimetry (MIP)	• ISO 15901 • 1 hr outgassing at 105 ± 3 ° C
	Water Adsorption	• Gravimetric method at 22 ± 3 ° C • 1 hr. outgassing at 105 ± 3 ° C • Adsorption and desorption points for varied relative humidity
	Zeta Potential Curves	• Streaming potential measurements from pH 3-10 for solid surfaces • 5 water quality recipes
	Contact Angle	• Liquids: deionized water, glycerol, 1-bromonapthalene • # measurement locations per coupon: ≥ 3 • # replicates/location: ≥ 5
B. *atrophaeus [9372]* Btk	Zeta Potential Curves	• Streaming potential measurements from pH 3-10 for particles • pH ~ 5.5 • Ionic strength 1-300 mM as KCl (minimum 10 ionic strengths)
	Contact Angle	• Spore lawns according to Brown and Jaffé (2006) • Location, liquids, and replicates same as above

Task 3:

Rainwater Simulator Performance Testing

Any rainwater simulator(s) used during the course of this project shall be characterized according to the following parameters: rain rate (at max and min operating pressure), spray pattern, wetted coupon area, droplet size distribution (at nozzle and at height of impact on the coupon), and droplet velocity. Five tests for each individual nozzle and multiple nozzles (in manifold) combinations shall be performed to characterize the rain that is being simulated for use in Task 5.

Task 4:

Evaluation of Overland Flow for Spore Removal from Surfaces

In this task, various flows of water shall be evaluated for spore removal from urban surface materials. Contamination starting condition shall be varied, such that dry aerosols, wet inoculums, and contaminants residing only in flow waters (not on coupons initially, but flowed over material coupons to determine losses to the surfaces) will be evaluated. Flow rate and slope shall also be varied. These evaluations shall occur over a minimum of 36 tests (each material-deposition combination at 2 flowrates and 2 slopes) for which washoff of spores is documented as evenly spaced samples from time of peak contamination release to steady state removal. A sufficient number of test and control replicates shall be included in the test matrix. Test variables are outlined in Table 2.

Table 2: Task 4 Test Variables

Tests	Materials	Flow Variables	Contamination Variable
1-36	Red brick Concrete Asphalt	Rate, Slope	Aerosol Deposition onto Dry Coupon, Wet Deposition onto Dry Coupon, Spores residing in Flow Water, *Bacillus atrophaeus* versus *Bacillus thuringiensis*

Task 5:

Determination of Spore Removal from Surfaces by Simulated Rain

In Task 5, at least 24 tests shall be conducted to determine the effectiveness of spore removal by simulated rainfall using the nozzles from Task 3 on red brick, concrete, and asphalt. Varying intensities of rain shall be evaluated for spore removal from surfaces.

Table 3: Task 5 Test Variables

Tests	Materials	Rain Variables	Contamination Variable
1-24	Red brick Concrete Asphalt	Rate (inch/hour)	Aerosol Deposition onto Dry Coupon, Wet Deposition onto Dry Coupon

Task 6:

Evaluation of washdown approaches for physical removal of surface biological contamination

In Task 6, at least 16 tests shall be conducted to determine the effectiveness of wash-down procedures on sections of selected outdoor material types (i.e., concrete, glass, etc.). Spray parameters such as nozzle type, flow rate, application duration, additives, and spray pattern (wash down from above on vertical surfaces versus perpendicular spray-down for vertical surfaces) shall be evaluated. In addition to determining surface removal effectiveness (by determining spore relocation into runoff liquid and aerosolization) shall be determined.

Test variables for Task 6 are outlined in Table 4.

Table 4: Task 6 Test Variables

Tests	Materials	Flow Variables	Contamination Variable
1-16	Concrete (horizontal), Glass (vertical),	Orientation (from above, from side), Pressure (up to fire hose or pressure washer), Rate, Duration, spray pattern	Aerosol Deposition onto Dry Coupon, Wet Deposition onto Dry Coupon

Task 7:

Determination of spore survival in saturated and unsaturated concrete and asphalt matrices

In Task 7, two approaches will be utilized to determine spore survival in common urban porous surface types (i.e., concrete and asphalt). Survival will be determined under saturated (covered in water) and unsaturated (dry) conditions. The two approached shall include (1) inoculation of small material coupons with spores, subjecting these coupons to saturated or unsaturated conditions for a duration of time (i.e., 1 month) and determining spore survival at 6 non-zero time points; or (2) mixing pulverized concrete or asphalt with spore inoculums, and determining

survival over time under saturated and unsaturated conditions. These data will aid in predicting spore fate and transport in a wide-area urban incident.

Task 8:

Determination of the relative impacts of spore viability reduction and sample collection efficiency reduction when exposed to urban matrices

In Task 8, the effects in Task 7 (concrete on spore viability) shall be further characterized. More specifically, the competing effects of reductions is sample collection efficiency and reduced spore viability (which both contribute to lower recoveries of viable spores) shall be quantitatively determined. The use of Coulter Counter to determine total particles recovered from inoculums and extract samples from concrete (three different concrete surfaces) over several time points (at least 5 points in hours to weeks) shall be compared to CFU (determined by culture). These methods shall be used to distinguish between 4 fractions; (1) viable and recoverable, (2) non-viable and recoverable, (3) viable and non-recoverable, and (4) non-viable and non-recoverable. The effort is expected to generate ~750 samples for analysis.

Additional Test Requirements:

- Wash-down liquids shall be confirmed to be free of confounding levels of background contamination prior to the initiation of each test.

- Air samples shall be taken in the decontamination chamber during the wash-down process to indicate the presence of resuspended viable spores. These samples shall be collected in accordance with the air sampling described in the approved QAPP entitled, Assessment of Liquid and Physical Decontamination Methods for Environmental Surfaces Contaminated with Bacterial Spores: Part 2 – Operational-scale Study of Full Decontamination Procedures (October 2009)."

- After completion of each test, the chamber and all contents shall be thoroughly decontaminated with a proven procedure.

- All samples shall be transferred to the on-site Microbiology Lab in sterile primary independent packaging within sterile secondary containment containing logical groups of samples. All samples shall be accompanied by a completed chain of custody form.

- All microbiological analysis for samples described in this SOW shall be performed by the on-site Microbiology Lab. This analysis is outside of the scope of this SOW.

- All tests shall be extensively and adequately photographed and video documented to convey the test procedures.

Reporting

The contractor shall design an MS Excel data reporting sheet template prior to the start of any work that conveys all relevant information from a test under Task 1 and 2. This template shall be approved by the EPA for use, prior to conducting any testing described in this SOW. All photographs and videos shall be properly documented, indicating the exact tests in which they were taken. A log (in MS Excel) of all photographs and videos shall be maintained with the electronic files. The log shall include a description of each photograph and video, and include the test number and date. All electronic files shall be stored in a project folder set up on the EPA's DTRL share drive. All information relevant to a test (reporting sheet, digital photographs, videos, log file) shall be transmitted to the EPA WAM within 1 week from the completion of the sample analysis. This data shall have been QA/QC'd by the contractor prior to transmission. Transmission shall occur via e-mail to the EPA WAM informing him/her that the data is ready for viewing.

A draft report detailing the test results and lessons learned from the testing shall be submitted to the EPA WAM within 30 days following the completion of the testing and no later than 2/10/2017. This report shall include documentation of the time required to complete each entire test procedure and all procedural steps. The report shall include any digital photos necessary to illustrate the findings. The draft report shall be submitted by the EPA WAM for review from within EPA, including a Quality Assurance review. A final report incorporating requested changes, correction, and clarification resulting from the review process shall be submitted by the contractor within 15 days from receiving the official comments from the EPA WAM. A separate document detailing the response to comments shall also be submitted to the EPA WAM by the contractor with the final version of the report. The Final Report shall be delivered no later than 3/20/2017.

XI. DELIVERABLE SCHEDULE

The deliverables previously described in this SOW with the scheduled due date are shown in Table 5.

Table 5: Deliverable Schedule

Deliverable	Due Date
QAPP amendment (if required)	15 working days after initiation of this Work Assignment
Draft Report	2/10/2017
Final Report	3/20/2017

XII. REPORTING REQUIREMENTS

- The monthly invoice reports for this work assignment shall provide a detailed description of any equipment or expendables that have been purchased by the contractor for use on the projects discussed herein.
- All data related to this project shall be stored on the U.S. EPA servers in the DTRL share folder.
- Data transfer to the EPA WAM shall occur within one week from the completion of data analysis.
- In lieu of final reports for each or any task, journal papers within each task may be submitted at the discretion of the EPA WAM. The papers shall be authored or co-authored by the EPA WAM, at the discretion of the WAM. To serve in lieu of the

final report, the journal articles must contain all of the relevant information that would have appeared in the final report.

- All products developed under this SOW (e.g., the above mentioned technical report) must conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-060

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Worth Calfee
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7600
FAX Number: 919-541-0496

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

PERFORMANCE WORK STATEMENT

EVALUATION OF LOW-TECH DECONTAMINATION METHODS UNDER OPERATIONALLY CHALLENGING ENVIRONMENTS

PROJECT# HS6.02.01-19

(APPCD ON-SITE CONTRACT EP-C-15-008)
WORK ASSIGNMENT 1-060

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HOMELAND SECURITY RESEARCH CENTER
DECONTAMINATION AND CONSEQUENCE MANAGEMENT DIVISION

I. TITLE 2
II. PERIOD OF PERFORMANCE 2
III. SUMMARY OF OBJECTIVES 2
IV. RELEVANCE 2
VI. SCOPE 3
VII. TECHNICAL APPROACH 3
VIII. AFFORDABILITY 4
IX. TECHNICAL RISK 4
X. FACILITIES AND MATERIALS 4
XI. TASKS 4
XII. DELIVERABLE SCHEDULE 8
XIII. REPORTING REQUIREMENTS 8
XIV. REFERENCES 9

TITLE
Evaluation of Low-Tech Decontamination Methods under Operationally Challenging Environments

I. PERIOD OF PERFORMANCE

The period of performance for the work under this work assignment shall be April 1, 2016 through March 31, 2017.

II. SUMMARY OF OBJECTIVES

This work shall estimate the occurrence and potential reduction of viable bacterial spores (i.e., effectiveness) as a function of the remediation activities applied under situations and conditions challenging to in-field operations.

III. RELEVANCE

This project supports the mission of the Decontamination and Consequence Management Division (DCMD) within the U.S. Environmental Protection Agency's (U.S. EPA) National Homeland Security Research Center (NHSRC) by providing relevant information pertinent to the decontamination of contaminated areas resulting from an act of terrorism. The project supports the EPA's Homeland Security Research Program (HSRP) and the NHSRC's strategic goals as described in detail in the Homeland Security Research Multi-year Strategic Plan (draft, November 26, 2008). Specifically, the project is relevant to Long-Term Goal 2 (LTG-2) which states, "The Office of Solid Waste and Emergency Response (OSWER) and other clients use homeland security research program products and expertise to improve the capability to respond to terrorist attacks affecting buildings and the outdoor environments." This project addresses a direct need expressed by OSWER's CBRN Consequence Management Advisory Division (CMAD). In addition, the project is relevant to the U.S. EPA's Office of Pesticide Programs (OPP) crisis exemption process and OPP's regulatory function under Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Due to the potential relevance of this project in preparing for the Federal response to wide-area anthrax incidents, this project will be managed by NHSRC with the support of a multidiscipline project team.

IV. BACKGROUND

Under Homeland Security Presidential Directive (HSPD)-10, the U.S. Department of Homeland Security (DHS) is tasked to coordinate with other appropriate Federal departments and agencies, to develop comprehensive plans which, "provide for seamless, coordinated Federal, state, local, and international responses to a biological attack." As part of these plans, the U.S. EPA, in a coordinated effort with DHS, is responsible for "developing strategies, guidelines, and plans for decontamination of persons, equipment, and facilities" to mitigate the risks of contamination following a biological weapons attack.

NHSRC provides expertise and products that can be widely used to prevent, prepare for, and recover from public health and environmental emergencies arising from terrorist threats and incidents. Within NHSRC, DCMD's decontamination research program's goal is to provide expertise and guidance on the selection and implementation of decontamination methods and provide the scientific basis for a significant reduction in the time and cost of decontamination events. The NHSRC's research supports OSWER and OPP. OSWER, through its Special

Teams which includes the CBRN CMAD, supports the emergency response functions carried out by the Regional Offices. OPP supports the decontamination effort by providing expertise on biological agent inactivation and ensuring that the use of pesticides in such efforts is done in accordance with FIFRA. Close collaboration between the different program offices having homeland security responsibilities is sought in order to rapidly increase the U.S. EPA's capabilities to help the Nation recover from a terrorist event involving the intentional release of CBR materials. Such collaborations are fostered through efforts such as PARTNER.

VI. SCOPE

The purpose of this project is to determine the effectiveness of a set of decontamination procedures which include spraying surfaces with sporicidal liquids, when rendered under "operationally challenging conditions and situations". Decontamination methods shall evaluated, when utilized under prescribed challenging conditions, by their efficacy (removal or inactivation of bacterial spores) and by their ability to be executed per the prescribed procedure without difficulty. A lower-tech approach, for the purpose of this effort, is defined as procedures not requiring specialized materials or equipment (i.e., products available at a local hardware store). The procedures to be tested are based upon the outcomes from previous work by EPA and the procedures were originally developed based use for the remediation of the wooden shed in Danbury, CT[1].

In Task 1, an Operational Guide shall be developed that is intended to aid field responders in cold weather decontamination using the liquid sporicides determined effective in the current study. The Operational Guide shall include instructions on sporicide formulation, mixing instructions, part numbers, and general spray-application guidelines. Note: the Operational Field Guide is due <u>no later than 6/1/2016</u>

In Task 2, at least three low-tech decontamination approaches shall be evaluated for decontamination effectiveness and operational ease under ten different challenging situations or environments.

The results of this task and previous testing under WA 0-060 shall be documented in a final report, as a function of independent variables and operational factors associated with each procedure.

VII. TECHNICAL APPROACH

The general approach that shall be used to meet the objectives of this project for both tasks is as follows, as briefly mentioned in the Section VI:

- inoculation of the materials with *Bacillus atrophaeus* (formerly, *Bacillus globigii*) spores via aerosol deposition using the procedures developed by Calfee et al., Journal of Microbiological Methods 2013(92375-380),
- application of prescribed decontamination methods or procedures under prescribed conditions;
- use of environmental test chamber and spray delivery system developed under EP-C-15-008, WA 0-060 to achieve environmental conditions prescribed by test matrix;

- assessment of residual viable spores (via post-decontamination sampling), starting inoculation (via sampling of positive controls), and potential cross-contamination (via sampling of negative controls [blanks]);
- analysis of subsequent decontamination procedure residues (e.g., waste, waste water or air samples);
- determination of decontamination effectiveness as measured by log reduction from the surfaces of test coupons compared to positive controls; and
- documentation of operational considerations (e.g., cross-contamination, procedural time, impacts on materials and personnel, difficulties during procedure, possible enhancements to procedure).

All sample analysis is outside of the scope of this work assignment. Samples shall be transferred to the NHSRC RTP Microbiology Lab for analysis under a separate work assignment (EP-C-15-008).

VIII. AFFORDABILITY

Components of this study are expected to be somewhat labor intensive; the decontamination processes, sampling, and laboratory assays will require extensive human resources. Relative to the labor costs, only a minimal amount of expendable materials are required to be purchased by the contractor for use in this effort.

IX. TECHNICAL RISK

The technical risk involved in this project is thought to be minimal. The purpose of the effort is to provide information pertinent to the development of operational strategies for the decontamination methods included in the study. Hence, all information obtained in this project (whether intended or not) is expected to be significantly relevant to this purpose.

X. FACILITIES AND MATERIALS

All work on this project described in this Performance Work Statement (PWS) shall be performed at the U.S. EPA's facilities located at 109 T.W. Alexander Dr., Research Triangle Park, NC. This study shall be conducted in H122A and/or H130A.

XI. TASKS

Prior to initiation of the testing described in the tasks below, a quality assurance project plan (QAPP) amendment shall be provided to EPA for review and comment, 15 working days after WA initiation. After revision based upon EPA comments (as necessary) and approval by EPA, work may commence. The QAPP amendment(s) must be approved by the U.S. EPA in writing (e.g., signature on the approval page) prior to the start of any work.

All test activities shall be fully documented during the activity via narratives in laboratory journals, the use of digital photography and video. This information shall be incorporated into the final report, as warranted to document and convey the findings of this effort. The documentation should include, but not be limited to, record of time required for each decontamination step or procedure, visual observations during the procedures, any deviations

from the test plans, physical impacts on the materials, and impacts on the decontamination or sampling personnel.

The technical approach to be used throughout this study shall be developed considering the background information provided in Section V and this section. This study shall be done in four major tasks. The specific details related to these tasks are described below.

Task 1:

The contractor shall prepare a QAPP amendment in accordance with Quality Assurance (QA) Category B. Attachment 1 to the PWS provides information regarding **NHSRC QA Requirements/Definitions List.**

QAPPs being developed for Category A (formerly Category 1 or 2) projects must be developed in accordance with the document titled "EPA Requirements for Quality Assurance Project Plans." EPA QA/R-5 can be found at http://www.epa.gov/sites/production/files/2015-07/documents/r5-final.pdf. At the discretion of the COR, a Category B (formerly category 3) QAPP can be developed based on the R5 guidance or a project-specific QA requirements provided on the NHSRC@work website. *The appropriate project-specific QA requirement information must be provided by the COR as Attachment 2* ***(optional).***

The **QAPP** must be approved prior to the start of any literature searches (existing data), data collection, gathering, synthesizing, or data generation (laboratory) work. Additional information related to QA requirements can be found at www.epa.gov/quality.

Task 2:

For Task 2, the contractor shall develop an Operational Guide for preparation and use of spray-based decontaminants in cold temperatures. The guide shall be written such that an emergency responder can follow the instructions easily, without ambiguity. The step-by-step preparation of decontaminant solutions shall be included, as well as product information (part#, vendor, city, etc). One or more decontaminants may be included in the guide, pending efficacy test data from EP-C-15-008 WA 0-060, and Task 3 of the current WA. The contractor shall submit the draft guide for review by the project team, and emergency response personnel identified by the WACOR. The guide will be revised at least two different times before finalizing.
NOTE: The Operational Field Guide deliverable is due no later than 6/1/2016.

Task 3:

For Task 3, the contractor shall devise and execute a series of laboratory-scale tests to evaluate decontamination procedures (efficacy and operational ease) under the sets of conditions or situations prioritized by the project team. Potential challenging environmental conditions include; cold temperatures, high temperatures with low humidity, and challenging material types. A conceptual test matrix for Task 3 is outlined in Table 2.

Table 2: Task 3 Test Matrix

Test	Decon	Challenging Condition
1	1	1
2	2	
3	3	
4	1	2
5	2	
6	3	
7	1	3
8	2	
9	3	
10	1	4
11	2	
12	3	
13	1	5
14	2	
15	3	
16	1	6
17	2	
18	3	
19	1	7
20	2	
21	3	
22	1	8
23	2	
24	3	
25	1	9
26	2	
27	3	
28	1	10
29	2	
30	3	

- The runoff of any liquid (rinsate) applied to the materials shall be collected, neutralized, and submitted to the NHSRC RTP Microbiology Lab for quantitative viable spore analysis via direct plating. This shall be done by collection of runoff in a sterilized container containing an appropriate amount of neutralizer (e.g., STS). Aliquots of the runoff shall be taken and filtered (rinsed) for analysis.

- Rinse water (if needed) shall be confirmed to be free of confounding levels of background contamination prior to the initiation of each test.

- After the decontamination, all surfaces shall be allowed to become visibly dry before being sampled. After at least a period of one day, post-decontamination sampling shall

be performed in accordance with the methods prescribed herein and defined in the approved final QAPP.

- All equipment (e.g., brushes, storage bins, etc.) shall be properly sterilized according to the procedures defined in the QAPP prior to the initiation of each test. The procedure is expected to be soaking or washing hard, non-porous materials with a pH-amended bleach solution. Proper decontamination includes selective verification of a representative number of items to be used in a test.

- After completion of each test, the chamber and all contents shall be thoroughly decontaminated with a proven procedure.

- All samples shall be transferred to the NHSRC RTP Microbiology Lab in sterile primary independent packaging within sterile secondary containment containing logical groups of samples. All samples shall be accompanied by a completed chain of custody form.

- All microbiological analysis for samples described in this PWS shall be performed by the NHSRC RTP Microbiology Lab. This analysis is outside of the scope of this PWS.

- All tests shall be extensively and adequately photographed and video documented to convey the test procedures.

Task 4:

For Task 4, the contractor shall evaluate compatibility of the top performing cold weather decontaminants with typical field-scale spray devices (pressure washer, chemical sprayer, backpack sprayer, etc.). The contractor shall develop a simple test matrix to test compatibility over 16 days, with intermittent use of the equipment with the decontaminant chemicals. An example Test Matrix is provided in Table 3. These data shall be used to recommend field-scale equipment for the Operational Guide. Procurement of spray devices may be necessary.

Table 3. Decontaminant Formulation Compatibility Testing Matrix

Test	Spray Device	Replicate Devices	Spray Duty Cycle	Decontaminant Formula
1	1	3	Spray 30 minutes, once every 4 days, for 16 days (0, 4, 8, 12, 16)	1
2	2			
3	3			
4	1			2
5	2			
6	3			
7	1			3
8	2			
9	3			

Reporting
The contractor shall design an MS Excel data reporting sheet template prior to the start of any work that conveys all relevant information from testing. This template shall be approved by the EPA for use, prior to conducting any testing described in this PWS. All photographs and videos shall be properly documented, indicating the exact tests in which they were taken. A log (in MS Excel) of all photographs and videos shall be maintained with the electronic files. The log shall include a description of each photograph and video, and include the test number and date. All electronic files shall be stored in a project folder set up on the EPA's DTRL share drive. All information relevant to a test (reporting sheet, digital photographs, videos, log file) shall be transmitted to the EPA WAM within 1 week from the completion of the sample analysis. These data shall have been QA/QC'd by the contractor prior to transmission. Transmission shall occur via e-mail to the EPA WAM informing him/her that the data is ready for viewing.

An operational field guide, for preparation and deployment of cold weather spray-based decontaminants shall be drafted by 6/1/2016. This draft guide shall be reviewed by the EPA project team, and revised by the contractor at least two times. The final guide is due to EPA by 7/15/16. A data summary report, for the cold temperature decon data (under WA 0-060 and 1-060) shall be provided by 7/15/2016. A final report, detailing the test results and lessons learned from the testing shall be submitted to the EPA WAM within 30 days following the completion of the testing and no later than 2/15/2017. This data summary shall include documentation of the time required to complete each entire test procedure and all procedural steps. The summary shall include any digital photos necessary to illustrate the findings.

XII. DELIVERABLE SCHEDULE

The deliverables previously described in this PWS with the scheduled due date are shown in Table 4.

Table 4: Deliverable Schedule

Deliverable	Due Date
QAPP Amendment	15 working days after initiation of this Work Assignment
Operational Guide for Field Use	6/1/2016
Cold Weather Decon Data Summary	7/15/16
Report	2/15/2017

XIII. REPORTING REQUIREMENTS

- The monthly invoice reports for this work assignment shall provide a detailed description of any equipment or expendables that have been purchased by the contractor for use on the projects discussed herein.
- All data related to this project shall be stored on the U.S. EPA servers in the DTRL share folder.
- Data transfer to the EPA WAM shall occur within one week from the completion of data analysis.
- In lieu of final reports for each or any task, journal papers within each task may be submitted at the discretion of the EPA WAM. The papers shall be authored or co-authored by the EPA WAM, at the discretion of the WAM. To serve in lieu of the

final report, the journal articles must contain all of the relevant information that would have appeared in the final report.

- All products developed under this PWS must conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

XIV. REFERENCES

1. After Action Report – Danbury Anthrax Incident, U.S. EPA Region 1, September 19, 2008.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-061

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name: 1-061 Biocontainment Lab Tech.

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 1, 6

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Worth Calfee
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7600
FAX Number: 919-541-0496

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Biocontaminant Laboratory Technical Support
Performance Work Statement

Project# HS6.02.01
Work Assignment 1-061
(APPCD ON-SITE CONTRACT EP-C-15-008)

TABLE OF CONTENTS

I	TITLE	1
II	PERIOD OF PERFORMANCE	1
III	SUMMARY OF OBJECTIVES	1
IV	RELEVANCE	1
V	BACKGROUND	1
VI	SCOPE	1
VII	TECHNICAL APPROACH	2
VIII	FACILITIES AND MATERIALS	3
IX	TASKS	3
X	MILESTONES, DELIVERABLES, AND COMPLETION DATES	4
XI	RESPONSABILITIES	5

I. TITLE: Biocontaminant Laboratory Technical Support

II. PERIOD OF PERFORMANCE

The period of performance for this work assignment shall be from the April 1, 2016 – March 31, 2017.

III. SUMMARY OF OBJECTIVES

The proposed work will provide microbiological support to on-going and planned research efforts conducted by EPA's National Homeland Security Research Center (NHSRC). Such support includes, but is not limited to, growth and maintenance of biological cultures and stocks; preparation of media and reagents used in microbiological analyses; organization, inventory, and upkeep of laboratory notebooks, glassware, equipment, and supplies; preparation of suspensions of various surrogate biological agents; sterilization of test materials and instruments; inoculation of coupons and materials used in decontamination studies; creation of new and update of existing MOPs used in decontamination research; and numerous laboratory analyses used to determine survivorship of biological agents in decontamination, disposal, and containment studies.

IV. RELEVANCE

The results of the work conducted under this WA study will be used to support other research projects related to the selection and application of candidate decontamination technologies for buildings or areas (i.e., indoor or outdoor scenarios) contaminated with biological warfare agents. Data generated through this work will also support containment and disposal-related homeland security research. The results of these works will be made available through published reports, journal papers, and conference abstracts and presentations.

V. BACKGROUND

Following a bioterrorist attack, materials contaminated with biological agent pose significant health threats. The EPA's NHSRC conducts research to develop methods and technologies able to rapidly and cost-effectively remediate areas affected by a bioterrorism attack. Tasks performed under this work assignment support such research.

VI. SCOPE

The objective of this work is to provide high-quality microbiological support to homeland security-related decontamination, disposal, and containment research projects. Most (but not all) of these projects being supported will be conducted via WAs under this contract as well. Such projects often require material coupons spiked with surrogate organisms as well as survivability analyses of coupons following treatment. For these tasks, laboratory technicians trained in aseptic techniques and general microbiological laboratory procedures shall carry out biological analyses on samples generated during decontamination, disposal, and containment research. Data generated and collected during these analyses shall be properly recorded and shared in a timely manner. In

addition, a significant amount of laboratory management is needed to sustain an efficient workflow.

VII. TECHNICAL APPROACH

Microbiological efforts will generally include the following activities: (1) preparation (e.g., sterilization) and analysis of coupons using various types of materials and biologicals (2) analysis of decontamination and containment research samples (3) developing standard diagnostic protocols for several decontamination technologies to assess microbial survivability (4) preparation of microbiological media and reagents (5) and timely reporting of data . Note: The treatment studies themselves (e.g., fumigation at specified conditions, rotary kiln operation, deposition studies, etc) will be conducted via the use of other WAs performed under this contract. The general purpose of this WA is to provide microbiological support for those other WAs. Additionally, projects may be initiated by the WAM in order to fully utilize personnel during periods of low workload.

The specific microbiological laboratory efforts will include (but not limited to) such things as the following:

(1) Spiking of coupons with the appropriate controls for any NHSRC decontamination, disposal, and/or containment projects.
(2) Growth and maintenance of the bacterial (and viral) cultures used for the standard diagnostic protocols
(3) Perform the survivability analyses as required by the projects mentioned above.
(4) Develop standard diagnostic protocols if necessary to assess microbial survivability
(5) Prepare, sterilize, dispense, and confirm sterility of microbiological media.
(6) Properly destroy and dispose of contaminated/spiked testing materials
(7) Maintain laboratory notebooks, supplies, reagents, microbiological media, equipment, and certificates.
(8) Operation and maintenance of in–house microbiological instruments and equipment.
(9) Evaluate data acquired and prepare reports documenting the results obtained, and the quality of the results. The reports shall include any tables, charts, graphs, drawings, or appendices necessary to fully explain the experiments performed, shall clearly document the results, and shall support the quality of data included.
(10) Provide the raw data to the WAM of this WA, and as well to the WAM of the project being supported. Data shall be provided electronically in a timely manner (as soon as available, not greater than 2 days following completion of the analysis generating said data) when requested or as indicated by a QAPP. All data sheets shall be legible, and contain all pertinent identifier information (i.e., technician name, date, number of WA being supported, analyses performed, organism, etc.)
(11) The contractor shall comply with all QA, outlined in the QAPPs developed under WA that provide samples for analysis by this WA.

(12) Electronic records management of sample ID's, Chains of custody, sample data, data tracking and reporting, etc. The staff shall work to develop a barcode based LIMS to increase workflow and efficiency.

(13) Use of Spiral Plating instruments, and Q-count automated colony enumerators

(14) Detailed recording of microbiological procedures in well-organized laboratory notebooks. Citation of MOPs rendered, time stamps for various activities, lengths of incubation, traceability of activities to individual technicians, etc. are expected to be recorded.

VIII. FACILITIES AND MATERIALS

All tasks described in this PWS shall be performed in-house, at the EPA's Research Triangle Park (RTP) facilities at 109 T.W. Alexander Dr. The Biocontaminant Laboratory located in E390 is a BSL-2 facility equipped with biological safety cabinets, microbial dynamic and static growth test chambers and bioaerosols test chambers as well as standard microbiological equipment such as steam autoclaves; incubators; refrigerators; centrifuges; light, fluorescent, and phase contrast microscopes, colony counters; and analytical balances.

IX. TASKS

To achieve the desired objective of this effort, the Microbiological work for this PWS can be broken down into five tasks.

Task 1. Coupon preparation and inoculation

The materials and size of the coupons shall be specified by the WAM based upon the inoculation and analytical procedures to be used, which will be specified in the QAPP for each WA the microbiology lab is supporting. There shall be at least three classes of coupons for each of the DCMD projects mentioned above: (1) positive controls, (2) negative controls, and (3) test coupons. The positive controls and test coupons shall be spiked with the appropriate biological surrogate (spores, vegetative bacteria, or virus). The negative controls shall undergo the coupon preparation (e.g., sterilization), but shall not be spiked with any target. The spiking procedure shall be appropriately documented in the QAPP. Method demonstration shall be performed and deemed acceptable to the WAM of this WA in conjunction with the WAM of the project the microbiology lab is supporting, prior to the inoculation of the coupons. The basis for acceptability shall be the acceptance criteria set-forth in the QAPP. All positive control, negative control, and test coupons shall be transferred from and to the Biocontaminant lab according to the delivery schedule to be discussed for each project. All transfers shall be accompanied by chain-of-custody (COC) form.

The described procedures are for planning purposes only and may be changed by the WAM, in consultation with the contractor, within the level of effort anticipated for the PWS as currently written. It is expected that approximately 10,000 test coupons or test samples shall be inoculated, sampled, and analyzed over the course of this option period.

Task 2. Agent Survivability analyses.

Agent growth on coupons will be evaluated qualitatively and quantitatively as specified in the standard operating procedures (MOPs 6516, 6526, 6527, 6528, 6529, 6535a, 6555, and 6566) of the Biocontaminant Laboratory Facility manual, or as specified in a QAPP. Under the guidance of the WAM, the contractor shall develop standard diagnostic protocols if necessary to assess survivability.

Task 3. Ancillary Research Projects

Additional projects may be designed and requested by the WAM to fully utilize the contractor personnel during periods of reduced workload. Such projects may include, but are not limited to: laboratory organization and cleaning, limit of detection studies, sampling efficiency studies, decontaminant technology application and efficacy studies, microbial characterization studies, bacterial spore purification studies, sampling and analysis methods development studies, and studies involving aerosol deposition of spores onto material surfaces. This task may require the contractor to briefly work in Highbay labs or other labs within the EPA-RTP facility.

Task 4. Laboratory Management

The efficiency of the Biocontaminant Laboratory workflow requires effective laboratory management as well as significant and vast knowledge of microbiological methods, theory, and principles. The microbiological lab manager should have previously demonstrated the ability to design and conduct microbiological investigations (for example, through Ph.D. dissertation), troubleshoot issues effectively, write documents and methods in scientific prose, and publish results in scientific journal (i.e, first or corresponding author).

All microbiological technical staff shall maintain laboratory notebooks of all activities; keep all utilized equipment up-to-date with regards to certification and routine maintenance; maintain inventories of frequently utilized chemicals, reagents, and media as to prevent delays in experimentation due to insufficient supplies; carefully plan all work as to maximize the use of staff; maintain and update MOPs and MSDS repository; perform periodic disinfection of laboratory surfaces and biological safety cabinets; maintain temperature records for laboratory incubators, refrigerators, and freezers; and promptly inform the WAM of any issues associated with laboratory work, workload, equipment failures, or supply needs. Media, supply, and reagent preparation (operation of automated plate pourer, autoclave, dishwasher, etc.) to support analyses are also the responsibility of this Work Assignment.

Task 5. Agent Recovery and Inoculum Preparations for Aerosol Testing Research

This task will involve providing microbiological support to on-going and new research initiatives involving aerosol testing. The Aerosol Test Facility (ATF) group will be utilizing agent preps, inoculated coupons, etc. prepared under this task. Also under this task, samples collected during bioaerosol testing within the ATF shall be analyzed for viable microorganisms. Approximately 2000 samples shall be analyzed by culture-based methods, and approximately 200 sample inocula shall be prepared over the course of this Task. The WAM will coordinate with those in the ATF group to ensure efficient transfer of samples between the laboratories. Data shall be reported to the WAM, and PI (indicated by the WAM), as data are available.

X. MILESTONES, DELIVERABLES, AND COMPLETION DATES

Data Delivery
Raw data (e.g., plate counts, qualitative growth results, etc.) shall be emailed to the WAM, and by carbon copy (cc) to the WAM of the project the microbiology lab is supporting, as soon as the data become available (not greater than 2 working days after completion of the analysis generating the data).

Reporting
The Contractor shall provide written quarterly status reports using an MS WORD format to the EPA Biocontaminant lab WAM. The reports shall be prepared specifying the following: (1) summary of work conducted during the preceding months, including tables and/or charts using MS EXCEL format, as appropriate, with sufficient annotation as deemed adequate by the EPA WAMs, (2) analyses of the work in accordance to the expectations specified by the QAPP of each project, (3) progress on each task and the reason for any deviations from the project schedule, (4) work anticipated during the coming quarter. These reports shall be submitted electronically near the end of each quarter. Additionally, pdf copies of the laboratory notebook, including the pages documenting activities performed during the period, shall be created and delivered electronically to the WAM the same day the quarterly report is delivered.

XI. RESPONSIBILITIES

This WA will be managed by the USEPA Office of Research and Development, National Homeland Security Research Center (NHSRC), Decontamination and Consequence Management Division (DCMD) in Research Triangle Park, NC. The Work Assignment Contractor Officer Representative will be M. Worth Calfee (phone 919-541-7600, email Calfee.Worth@epa.gov).

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-063

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base X Option Period Number	1-063

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 1, 2, 6

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Worth Calfee (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7600 FAX Number: 919-541-0496
Project Officer Name Robin Baily (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Mark Cranley (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

PERFORMANCE WORK STATEMENT

DECONTAMINATION OF HEAVILY SOILED SURFACES

PROJECT# HS8.62.01 - 437

WORK ASSIGNMENT 1-63

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HOMELAND SECURITY RESEARCH CENTER
DECONTAMINATION AND CONSEQUENCE MANAGEMENT DIVISION

I. TITLE 2
II. PERIOD OF PERFORMANCE 2
III. SUMMARY OF OBJECTIVES 2
IV. RELEVANCE 2
VI. SCOPE 3
VII. TECHNICAL APPROACH 3
VIII. AFFORDABILITY 3
IX. TECHNICAL RISK 4
X. FACILITIES AND MATERIALS 4
XI. TASKS 4
XII. DELIVERABLE SCHEDULE 7
XIII. REPORTING REQUIREMENTS 7

TITLE
Decontamination of Heavily Soiled Surfaces

I. PERIOD OF PERFORMANCE

The period of performance for the work under this work assignment shall be from April 1, 2016 through March 31, 2017.

II. SUMMARY OF OBJECTIVES

To conduct decontamination tests on heavily soiled surfaces, and generate report for findings of previous and current tests with MS2 and *Bacillus atrophaeus* testing on grimed and non-grimed surfaces.

III. RELEVANCE

This project supports jointly held missions of the U.S. Department of Homeland Security and the U.S. Environmental Protection Agency (U.S. EPA). Within the U.S. EPA, this project supports the mission of the Decontamination and Consequence Management Division (DCMD) within the U.S. Environmental Protection Agency's (U.S. EPA) National Homeland Security Research Center (NHSRC) by providing relevant information pertinent to the decontamination of contaminated areas resulting from an act of terrorism. The project supports the EPA's Homeland Security Research Program (HSRP) and the NHSRC's strategic goals as described in detail in the Homeland Security Research Multi-year Strategic Plan (draft, November 26, 2008). Specifically, the project is relevant to Long-Term Goal 2 (LTG-2) which states, "The Office of Solid Waste and Emergency Response (OSWER) and other clients use homeland security research program products and expertise to improve the capability to respond to terrorist attacks affecting buildings and the outdoor environments." This project addresses a direct need expressed by OSWER's CBRN Consequence Management Advisory Team (CMAT). In addition, the project is relevant to the U.S. EPA's Office of Pesticide Programs (OPP) crisis exemption process and OPP's regulatory function under Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Due to the potential relevance of this project in preparing for the Federal response to a wide-area anthrax dissemination, this project will be managed by NHSRC with the support of a multidiscipline project team.

V. BACKGROUND

Under Homeland Security Presidential Directive (HSPD)-10, the U.S. Department of Homeland Security (DHS) is tasked to coordinate with other appropriate Federal departments and agencies, to develop comprehensive plans which, "provide for seamless, coordinated Federal, state, local, and international responses to a biological attack." As part of these plans, the U.S. EPA, in a coordinated effort with DHS, is responsible for "developing strategies, guidelines, and plans for decontamination of persons, equipment, and facilities" to mitigate the risks of contamination following a biological weapons attack.

NHSRC provides expertise and products that can be widely used to prevent, prepare for, and recover from public health and environmental emergencies arising from terrorist threats and incidents. Within NHSRC, DCMD's decontamination research program's goal is to provide expertise and guidance on the selection and implementation of decontamination methods and provide the scientific basis for a significant reduction in the time and cost of decontamination

events. The NHSRC's research supports OSWER and OPP. OSWER, through its Special Teams which includes the CBRN CMAT, supports the emergency response functions carried out by the Regional Offices. OPP supports the decontamination effort by providing expertise on biological agent inactivation and ensuring that the use of pesticides in such efforts is done in accordance with FIFRA. Close collaboration between the different program offices having homeland security responsibilities is sought in order to rapidly increase the U.S. EPA's capabilities to help the Nation recover from a terrorist event involving the intentional release of CBR materials. Such collaborations are fostered through efforts such as PARTNER.

Releases of Biological Materials can be in the form of intentional and directed releases of organisms, such as the anthrax mailings of 2001; or can be in the form of foreign animal disease (FAD) incidents. Either scenario pose significant challenges with regards to determining the extent of contamination, containing the contaminant spread, and remediating such that reoccupancy can occur. The current effort supports multi-agency objectives of better understanding and preparing for remediation of heavily soiled surfaces following a biological release.

VI. SCOPE

The purpose of this project is to evaluate common decontamination methods for inactivation of Bacillus spores or a viral agent (surrogate for FMDV) on test surfaces. Test materials (concrete and treated wood) should be loaded with an amount and type of grime/soil that reflects challenging environments expected to be encountered during wide-area decontaminations. Grime formulations and sampling methods developed previously under this project shall be utilized. A report shall be drafted to document the methods and findings of this effort.

VII. TECHNICAL APPROACH

The general approach that shall be used to meet the objectives of this project is as follows:

A known quantity of surrogate organism will be deposited on large coupons (1 $ft.^2$ or greater) of different materials common to agricultural settings, which may include unpainted (smooth finish) concrete and treated plywood. Additional organic burden will be added to a subset of the test replicates to assess the impact of surface-associated soil/grime on decon efficacy. The coupons will then be treated with the selected cleaning and disinfection methods, and the effectiveness of each method will then be measured by the reduction of spores achieved. Spore relocation to aerosol and rinsate fractions shall be determined as well. All test parameters, such as test chamber size, coupon materials and sizes, decontamination methods, methods of application, contact time, spore type and environmental test conditions will be determined by agreement among participating experts. The collective set of tests must be able to be completed within the allotted budget.

VIII. AFFORDABILITY

Components of this study are expected to be somewhat labor intensive; the decontamination processes, sampling, and laboratory assays will require extensive human resources. Relative to the labor costs, only a minimal amount of expendable materials are required to be purchased by

the contractor for use in this effort.

IX. TECHNICAL RISK

The technical risk involved in this project is thought to be moderate. Bacterial spores are expected to be resistant to inactivation in soil/grime matrices; however viral surrogates may be less persistent in such unfavorable conditions. There exists some risk that no soiled condition will permit recovery of viral surrogates from surfaces. These data may suggest that viral persistence in soiled matrices is not high; however, these data would be circumstantial. The purpose of the effort is to provide information pertinent to the test parameter development. Such parameters will be used in subsequent decontamination method testing. Hence, all information obtained in this project (whether intended or not) is expected to be significantly relevant to wide-area decontamination.

X. FACILITIES AND MATERIALS

All work on this project described in this performance work statement (PWS) shall be performed at the U.S. EPA's facilities located at 109 T.W. Alexander Dr., Research Triangle Park, NC. This study shall be conducted in H122A and/or H130A.

XI. TASKS

The Tasks outlined in this SOW shall be conducted according to the existing Category IV quality assurance project plan (QAPP) entitled "Decontamination of Heavily Soiled Surfaces – Part I – Summary of Scoping Tests for Follow-up Decontamination Testing" and Amendment 1 to the QAPP, "Decontamination of Heavily Soiled Surfaces, Decontamination Study" (both approved by EPA QA).

All test activities shall be fully documented during the activity via narratives in laboratory journals, the use of digital photography and video. This information shall be incorporated into the final report, as warranted to document and convey the findings of this effort. The documentation should include, but not be limited to, record of time required for each decontamination step or procedure, visual observations during the procedures, any deviations from the test plans, physical impacts on the materials, and impacts on the decontamination or sampling personnel.

The technical approach to be used throughout this study shall be developed considering the background information provided in Section V and this section. This study shall be done in two major tasks. The specific details related to these tasks are described below.

Task 1:

Conduct six laboratory-scale decontamination tests, in accordance with the abovementioned QAPP. The test matrix and variables to be included are shown in Table 1. Test design should follow that reported in EPA600/R-11/092. Tests shall evaluate various spray-based decontamination methods, for efficacy against spores or virus surrogate organisms, on wood and concrete surfaces (Table 2), with and without agricultural grime (Table 3).

Table 1: Test Matrix

Test	Test Organism	Decontaminant	Sprayer	Material Type	Coupon Condition	Total# Test Samples*
1	B. atrophaeus	SporKlenz	Chemical Sprayer	Plywood	Neat	10
2					Grimed	
3-6	TBD	TBD	TBD	TBD	TBD	TBD

five (5) test coupons, TCs; three (3) positive controls (PCs), one (1) procedural blank (PB), one (1) negative control;

Table 2. Material specifics for coupons

Material	Description	Manufacturer/ Supplier Name	Coupon Surface Size, L x W	Material Preparation
Pressure-Treated Wood	3/4" thick, 4' by 8' ACQ-D pressure treated plywood	Georgia-Pacific/Lowe's	14" x 14"	- Remove wood particles using soft-briste brush - Sterilize (VHP®)
Concrete	Quikrete Type I & II Portland Cement; Quikrete All Purpose Sand	The QUIKRETE® Companies/Lowe's	14" x 14"	- Remove particles by powerwashing - After powerwashing, allow to air dry in climate-controlled environments for at least five days - Sterilize (autoclave)
Stainless Steel	Multipurpose Stainless Steel (48" x 48"), type 304, #2B mill (unpolished), 0.036" thick	McMaster-Carr	14" x 14"	- Remove any lubricant/grease from shearing with acetone and wipe dry - Remove particles and dust by wiping clean with water and wipe dry - Sterilize (autoclave)

Table 3. Constituents for Grime Manufacturing

Raw Material Name	Trade Name	Manufacturer	CAS #	Product #
Natural humus	Ancient Forest .5 CF Humus Soil Amendment	General Organics, USA	NA	GH3200
Paraffin oil	Paraffin oil; puris	Sigma-Aldrich, USA	8012-95-1	18512-1L
Used crankcase motor oil	NA	Obtain from any local auto service station	NA	NA

Raw Material Name	Trade Name	Manufacturer	CAS #	Product #
Portland cement	QUIKRETE® Portland Cement	**QUIKRETE®, USA**	NA	1124
Silica	Silicon dioxide, ~99%, 0.5-10 µm	Sigma-Aldrich, USA	14808-60-7	S5631-1KG
Carbon black	Raven 401	Powder Technology Inc., PTI, USA		
Oleic acid	Oleic acid technical grade, 90%	Sigma-Aldrich, USA	112-80-1	364525-1L
Kaolin clay	Kaolin*	Sigma-Aldrich, USA	1332-58-7	18672-2.5KG
Iron oxide	**Ferric oxide**	Sigma-Aldrich, USA	1309-37-1	310050-500G
Stearic acid	Stearic acid ≥95%	Sigma-Aldrich, USA	57-11-4	W303518-1KG-K
Lanolin	Lanolin	Sigma-Aldrich, USA	8006-54-0	L7387-1KG
Manure	Dried homogenized 50%/50% hog/cow manure	The Animal and Poultry Waste Management Center at North Carolina State University, USA	NA	NA

Task 3:
Update Report from Previous Option with new data, revise report per EPA WACOR, EPA Peer-Reviewer, and EPA QA comments. Deliver Updated EPA Report to WACOR.

Reporting
The contractor shall design an MS Excel data reporting sheet template prior to the start of any work that conveys all relevant information from a test under Task 1. This template shall be approved by the EPA for use, prior to conducting any testing described in this SOW. All photographs and videos shall be properly documented, indicating the exact tests in which they were taken. A log (in MS Excel) of all photographs and videos shall be maintained with the electronic files. The log shall include a description of each photograph and video, and include the test number and date. All electronic files shall be stored in a project folder set up on the EPA's DTRL share drive. All information relevant to a test (reporting sheet, digital photographs, videos, log file) shall be transmitted to the EPA WACOR within 1 week from the completion of the sample analysis. This data shall have been QA/QC'd by the contractor prior to transmission. Transmission shall occur via e-mail to the EPA WACOR informing him/her that the data is ready for viewing.

A draft final report detailing the test results and lessons learned from the testing shall be submitted to the EPA WACOR within 30 days following the completion of the testing and no later than 2/15/2017. This report shall include documentation of the time required to complete each entire test procedure and all procedural steps. The report shall include any digital photos necessary to illustrate the findings. The draft report shall be submitted by the EPA WACOR for review from within EPA, including a Quality Assurance review. A final report incorporating requested changes, correction, and clarification resulting from the review process shall be submitted by the contractor within 5 working days from receiving the official comments from the EPA WACOR. A separate document detailing the response to comments shall also be submitted to the EPA WACOR by the contractor with the final version of the report.

XII. DELIVERABLE SCHEDULE

The deliverables previously described in this SOW with the scheduled due date are shown in Table 4.

Table 4: Deliverable Schedule

Deliverable	Due Date
Draft Report	2/15/2017

XIII. REPORTING REQUIREMENTS

- The monthly invoice reports for this work assignment shall provide a detailed description of any equipment or expendables that have been purchased by the contractor for use on the projects discussed herein.
- All data related to this project shall be stored on the U.S. EPA servers in the DTRL share folder.
- Data transfer to the EPA WACOR shall occur within one week from the completion of data analysis.
- In lieu of final reports for each or any task, journal papers within each task may be submitted at the discretion of the EPA WACOR. The papers shall be authored or co-authored by the EPA WACOR, at the discretion of the WACOR. To serve in lieu of the final report, the journal articles must contain all of the relevant information that would have appeared in the final report.
- All products developed under this SOW (e.g., the above mentioned technical report) must conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-064

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base X Option Period Number	1-064

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 1-6

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — **Accounting and Appropriations Data** — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Sangdon Lee (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-4531 FAX Number:	
Project Officer Name Robin Baily (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:	
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:	
Contracting Official Name Mark Cranley (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109	

PERFORMANCE WORK STATEMENT

Optimization of Critical Parameters for Aggressive Air Sampling

PROJECT# HS 7.52.02-486

WORK ASSIGNMENT 1-064

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HOMELAND SECURITY RESEARCH CENTER
DECONTAMINATION AND CONSEQUENCE MANAGEMENT DIVISION

I. PERIOD OF PERFORMANCE 2
II. SUMMARY OF OBJECTIVES 2
III. RELEVANCE 2
IV. BACKGROUND 2
V. SCOPE 33
VI. TECHNICAL APPROACH 33
VII. FACILITIES AND MATERIALS 33
VIII. TASKS 44
IX. DELIVERABLE SCHEDULE 55
X. X. RESPONSIBILITIES 55

TITLE

Optimization of Critical Parameters for Aggressive Air Sampling

I. PERIOD OF PERFORMANCE

The period of performance for the work under this work assignment shall be April 1, 2016 through March 31, 2017.

II. SUMMARY OF OBJECTIVES

The goal of this work is to improve the aggressive air sampling (AAS) method for use in sampling *Bacillus anthracis* spores under various environmental conditions.

III. RELEVANCE

This project supports the mission of the Decontamination and Consequence Management Division (DCMD) within the U.S. Environmental Protection Agency's (U.S. EPA) National Homeland Security Research Center (NHSRC) by providing relevant information pertinent to the decontamination of contaminated areas resulting from an act of terrorism. The project supports the EPA's Homeland Security Research Program (HSRP) and the NHSRC's strategic goals as described in detail in the Homeland Security Research Multi-year Strategic Plan (draft, November 26, 2008). Specifically, the project is relevant to Long-Term Goal 2 (LTG-2) which states, "The Office of Land and Emergency Response (OLEM) and other clients use homeland security research program products and expertise to improve the capability to respond to terrorist attacks affecting buildings and the outdoor environments." This project addresses a direct need expressed by OLEM's CBRN Consequence Management Advisory Division (CMAT), regarding an understanding and optimizing composite-based sampling for a wide area anthrax incident. Due to the potential relevance of this project in preparing for the Federal response to wide-area anthrax incidents, this project will be managed by NHSRC with the support of a multidiscipline project team.

IV. BACKGROUND

In the event of a release of biological material in an urban area that would require decontamination for the purpose of public safety. In such an event, a wide range of surfaces would be contaminated. The Environmental Protection Agency (EPA) has the responsibility for protecting human health and the environment from these contaminated areas. Accurate measurements of residual contamination are needed to inform decisions on re-entry and reoccupation of spaces following site decontamination. For a wide area contamination incident, traditional surface sampling methods (i.e., wipe, swab and vacuum sock) used for clearance sampling may require an extensive number of samples, which may be time and labor intensive to achieve a reasonable confidence. Judgmental sampling is an alternate strategy which can reduce the total number of samples. However, statistical analyses of results from this sampling strategy are not applicable. Innovative techniques, such as Aggressive Air Sampling (AAS), may prove useful as an additional method to currently-used surface sampling methods and, with additional

research, may be used as an alternative method in certain situations (i.e., detection of spore presence from unknown hot spots, wide spread contamination with concentration close to detection limit for surface sampling methods, etc.), and effectively shorten the timeline to recovery and/or reduce the sampling burden during a response. AAS could be used for numerous building interiors for rapid sampling with fewer required personnel, and in certain scenarios such as covert wide area contamination, could reduce the total number of samples per unit area compared to the current surface sampling methods. Given that surface sampling is one of the critical bottlenecks in the remediation process, AAS could ultimately result in a decrease in overall cleanup time. Unlike surface sampling, AAS indicates airborne concentrations of respirable size particles that can be used to assess risk of inhalation exposure and as a result, risk of inhalation anthrax. Surface sampling does not differentiate particle size nor does it allow for determining the fraction of particles that could become re-aerosolized. The purpose of this Work Assignment is to help determine appropriate AAS procedures for Bacillus anthracis sampling. The U.S. Environmental Protection Agency (EPA)/National Homeland Security Research Center (NHSRC) will support this work.

V. SCOPE

The purpose of this project is to determine the effectiveness of AAS and other composite methods for sampling spores from subway surfaces including platform and rail surfaces under various environmental conditions.

VI. TECHNICAL APPROACH

Laboratory tests: a known quantity of *Bacillus* spores will be deposited by aerial dispersion onto large coupons fabricated to contain ballasts that can be commonly found from a subway rail system. The coupons will then be sampled using the Aggressive Air sampling method. AAS efficacy will be determined for varied environmental conditions according to culture-based microbiological assays developed by EPA and CDC. All test parameters, such as test chamber size, coupon materials and sizes, sampling methods, methods of extraction / analysis will be determined by agreement among the EPA project team.

Field tests: three different composite sampling methods, AAS, commercial wet vacuum, and cleaning robots, will be tested for their sampling effectiveness in a mock subway system located at the Fort A.P. Hill, VA during the joint exercise with Department of Homeland Security in September 2016. Three methods will be utilized to sample spores from subway surfaces after decontamination. The samples collected during the field tests will be analyzed according to culture-based microbiological assays developed by EPA and CDC.

VII. FACILITIES AND MATERIALS

All laboratory work on this project described in this performance work statement (PWS) shall be performed at the U.S. EPA's facilities located at 109 T.W. Alexander Dr., Research Triangle Park, NC. This study shall be conducted in B205.

The field tests on this project described in this PWS shall be performed at the Fort A.P. Hill, VA. The sample analyses shall be conducted in the Microbiology lab, located in E-386, E-388, and E-390 at the U.S. EPA's facilities located at 109 T.W. Alexander Dr., Research Triangle Park, NC.

VIII. TASKS

To achieve the desired objective of this effort, work for this PWS can be broken down into four tasks. These tasks are a continuation of the testing outlined in the QAPP developed during the previous option.

Task 1. QAPP Development

The contractor shall prepare a QAPP in accordance with Quality Assurance (QA) Category_B_. Attachment 1 to the PWS provides information regarding NHSRC QA Requirements/Definitions List.

QAPPs being developed for Category A (formerly Category 1 or 2) projects must be developed in accordance with the document titled "EPA Requirements for Quality Assurance Project Plans." EPA QA/R-5 can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf. At the discretion of the COR, a Category B (formerly category 3) QAPP can be developed based on the R5 guidance or a project-specific QA requirements provided on the NHSRC@work website.

The QAPP must be approved prior to the start of any literature searches (existing data), data collection, gathering, synthesizing, or data generation (laboratory) work. Additional information related to QA requirements can be found at www.epa.gov/quality.

Task 2. Laboratory Experimentation

In Task 2, the contractor shall conduct experiments to measure the sampling efficacy of AAS on ballast surfaces. All tests shall be conducted using the same test chamber in the QAPP, Identification of critical parameters for aggressive air sampling. The AAS efficacies on ballast surfaces will be measured as a function of relative humidity (30 vs. 85 RH %), decontamination agent application (fog and liquid), spore types (atrophaeus vs. Btk) and spore loadings (1E2 to 1E6 per ft2). For these tests, experimentation shall be carried out in accordance with the QAPP. Deviations from the QAPP shall be documented in writing and justified.

Task 3. Field Sampling

In Task 3, the contractor shall conduct field sampling using AAS, wet vacuum, and cleaning robot methods in a mock subway system at the Fort A.P. Hill, VA in September, 2016. The exact dates, field details, and sampling locations will be provided by the EPA WACOR. The contractor shall prepare all materials for three sampling methods for up to 5 sampling events. The contractor shall prepare the written procedures for three sampling methods. The contractor shall calibrate, sterilize, and ship sampling equipment for field tests as needed. The samples from field measurements will be packaged and shipped to the EPA RTP laboratory for analysis.

Task 4. Report Preparation

In Task 4, the contractor shall prepare a full report detailing the test results and lessons learned from the testing. The report shall follow the EPA report format. This report shall include

documentation of the time required to complete each entire test procedure and all procedural steps. The report shall include any digital photos necessary to illustrate the findings. The draft report shall be submitted by the EPA WACOR for review from within EPA, including a Quality Assurance review. A final report incorporating requested changes, correction, and clarification resulting from the review process shall be submitted by the contractor within 15 days from receiving the official comments from the EPA WACOR. A separate document detailing the response to comments shall also be submitted to the EPA WACOR by the contractor with the final version of the report.

The results of all tasks shall be documented in one final report discussing sampling efficacy as a function of independent variables and operational factors associated with each removal method. A draft report shall be provided to the U.S. EPA Work Assignment Contracting Officer Representative (EPA WACOR) for review and comment. A final report incorporating comments from the EPA WACOR, and including a separate documentation of the disposition of comments, shall also be provided as the final deliverable on this work assignment. All products developed under this PWS (e.g., the above mentioned technical report) must conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

IX. DELIVERABLE SCHEDULE

QAPP Amendment
A draft QAPP and Work Plan shall be provided within 30 days of the award of this agreement. This shall be provided prior to commencement of the tests described within this PWS. The QAPP and Work Plan shall include scope, scheduling, and costing information for each of the tests planned.

Reporting
A Draft Report shall be provided to EPA for review by March 1, 2017. A final report shall be provided 10 business days after EPA comments.

X. X. RESPONSIBILITIES

This project is initiated by the USEPA Office of Research and Development, National Homeland Security Research Center (NHSRC), Decontamination and Consequence Management Division (DCMD) in Research Triangle Park, NC. This project is a collaborative effort with the US Department of Homeland Security. The U.S. EPA WACOR shall be Dr. Sang Don Lee (phone 919-541-4531, email lee.sangdon@epa.gov). Dr. Worth Calfee shall be alternate WACOR.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-064

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2016
Base Option Period Number 1

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:
The purpose of this WA amendment is to revise the PWS to add additional task (changes are highlighted in yellow).

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2016 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee — LOE:

Cumulative Approved: — Cost/Fee — LOE:

Work Assignment Manager Name: Sangdon Lee
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-4531
FAX Number:

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

PERFORMANCE WORK STATEMENT

Optimization of Critical Parameters for Aggressive Air Sampling

PROJECT# HS 7.52.02-486

WORK ASSIGNMENT 1-064

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HOMELAND SECURITY RESEARCH CENTER
DECONTAMINATION AND CONSEQUENCE MANAGEMENT DIVISION

I. PERIOD OF PERFORMANCE 2
II. SUMMARY OF OBJECTIVES 2
III. RELEVANCE 2
IV. BACKGROUND 2
V. SCOPE ..... 3~~3~~
VI. TECHNICAL APPROACH ..... 3~~3~~
VII. FACILITIES AND MATERIALS ..... 3~~3~~
VIII. TASKS ..... 4~~4~~
IX. DELIVERABLE SCHEDULE ..... 5~~5~~
X. X. RESPONSIBILITIES ..... 5~~5~~

TITLE

Optimization of Critical Parameters for Aggressive Air Sampling

I. PERIOD OF PERFORMANCE

The period of performance for the work under this work assignment shall be April 1, 2016 through March 31, 2017.

II. SUMMARY OF OBJECTIVES

The goal of this work is to improve the aggressive air sampling (AAS) method for use in sampling *Bacillus anthracis* spores under various environmental conditions.

III. RELEVANCE

This project supports the mission of the Decontamination and Consequence Management Division (DCMD) within the U.S. Environmental Protection Agency's (U.S. EPA) National Homeland Security Research Center (NHSRC) by providing relevant information pertinent to the decontamination of contaminated areas resulting from an act of terrorism. The project supports the EPA's Homeland Security Research Program (HSRP) and the NHSRC's strategic goals as described in detail in the Homeland Security Research Multi-year Strategic Plan (draft, November 26, 2008). Specifically, the project is relevant to Long-Term Goal 2 (LTG-2) which states, "The Office of Land and Emergency Response (OLEM) and other clients use homeland security research program products and expertise to improve the capability to respond to terrorist attacks affecting buildings and the outdoor environments." This project addresses a direct need expressed by OLEM's CBRN Consequence Management Advisory Division (CMAT), regarding an understanding and optimizing composite-based sampling for a wide area anthrax incident. Due to the potential relevance of this project in preparing for the Federal response to wide-area anthrax incidents, this project will be managed by NHSRC with the support of a multidiscipline project team.

IV. BACKGROUND

In the event of a release of biological material in an urban area that would require decontamination for the purpose of public safety. In such an event, a wide range of surfaces would be contaminated. The Environmental Protection Agency (EPA) has the responsibility for protecting human health and the environment from these contaminated areas. Accurate measurements of residual contamination are needed to inform decisions on re-entry and reoccupation of spaces following site decontamination. For a wide area contamination incident, traditional surface sampling methods (i.e., wipe, swab and vacuum sock) used for clearance sampling may require an extensive number of samples, which may be time and labor intensive to achieve a reasonable confidence. Judgmental sampling is an alternate strategy which can reduce the total number of samples. However, statistical analyses of results from this sampling strategy are not applicable. Innovative techniques, such as Aggressive Air Sampling (AAS), may prove useful as an additional method to currently-used surface sampling methods and, with additional

research, may be used as an alternative method in certain situations (i.e., detection of spore presence from unknown hot spots, wide spread contamination with concentration close to detection limit for surface sampling methods, etc.), and effectively shorten the timeline to recovery and/or reduce the sampling burden during a response. AAS could be used for numerous building interiors for rapid sampling with fewer required personnel, and in certain scenarios such as covert wide area contamination, could reduce the total number of samples per unit area compared to the current surface sampling methods. Given that surface sampling is one of the critical bottlenecks in the remediation process, AAS could ultimately result in a decrease in overall cleanup time. Unlike surface sampling, AAS indicates airborne concentrations of respirable size particles that can be used to assess risk of inhalation exposure and as a result, risk of inhalation anthrax. Surface sampling does not differentiate particle size nor does it allow for determining the fraction of particles that could become re-aerosolized. The purpose of this Work Assignment is to help determine appropriate AAS procedures for Bacillus anthracis sampling. The U.S. Environmental Protection Agency (EPA)/National Homeland Security Research Center (NHSRC) will support this work.

V. SCOPE

The purpose of this project is to determine the effectiveness of AAS and other composite methods for sampling spores from subway surfaces including platform and rail surfaces under various environmental conditions.

VI. TECHNICAL APPROACH

Laboratory tests: a known quantity of *Bacillus* spores will be deposited by aerial dispersion onto large coupons fabricated to contain ballasts that can be commonly found from a subway rail system. The coupons will then be sampled using the Aggressive Air sampling method. AAS efficacy will be determined for varied environmental conditions according to culture-based microbiological assays developed by EPA and CDC. All test parameters, such as test chamber size, coupon materials and sizes, sampling methods, methods of extraction / analysis will be determined by agreement among the EPA project team.

Field tests: three different composite sampling methods, AAS, commercial wet vacuum, and cleaning robots, will be tested for their sampling effectiveness in a mock subway system located at the Fort A.P. Hill, VA during the joint exercise with Department of Homeland Security in September 2016. Three methods will be utilized to sample spores from subway surfaces after decontamination. The samples collected during the field tests will be analyzed according to culture-based microbiological assays developed by EPA and CDC.

VII. FACILITIES AND MATERIALS

All laboratory work on this project described in this performance work statement (PWS) shall be performed at the U.S. EPA's facilities located at 109 T.W. Alexander Dr., Research Triangle Park, NC. This study shall be conducted in B205.

The field tests on this project described in this PWS shall be performed at the Fort A.P. Hill, VA. The sample analyses shall be conducted in the Microbiology lab, located in E-386, E-388, and E-390 at the U.S. EPA's facilities located at 109 T.W. Alexander Dr., Research Triangle Park, NC.

VIII. TASKS

To achieve the desired objective of this effort, work for this PWS can be broken down into four tasks. These tasks are a continuation of the testing outlined in the QAPP developed during the previous option.

Task 1. QAPP Development

The contractor shall prepare a QAPP in accordance with Quality Assurance (QA) Category_B_. Attachment 1 to the PWS provides information regarding NHSRC QA Requirements/Definitions List.

QAPPs being developed for Category A (formerly Category 1 or 2) projects must be developed in accordance with the document titled "EPA Requirements for Quality Assurance Project Plans." EPA QA/R-5 can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf. At the discretion of the COR, a Category B (formerly category 3) QAPP can be developed based on the R5 guidance or a project-specific QA requirements provided on the NHSRC@work website.

The QAPP must be approved prior to the start of any literature searches (existing data), data collection, gathering, synthesizing, or data generation (laboratory) work. Additional information related to QA requirements can be found at www.epa.gov/quality.

Task 2. Laboratory Experimentation

In Task 2, the contractor shall conduct experiments to measure the sampling efficacy of AAS on ballast surfaces. All tests shall be conducted using the same test chamber in the QAPP, Identification of critical parameters for aggressive air sampling. The AAS efficacies on ballast surfaces will be measured as a function of relative humidity (30 vs. 85 RH %), decontamination agent application (fog and liquid), spore types (atrophaeus vs. Btk) and spore loadings (1E2 to 1E6 per ft2). The contractor shall conduct the laboratory testing to assess the use of Negative Air Machine (NAM) for AAS. The contractor shall amend the existing QAPP to include the test matrix for NAM evaluation. Tests will be designed to determine the necessary operational conditions to achieve the best sampling efficacy by using NAM. The test conditions will include NAM flow rate, filter type and size, NAM filter location, and any other operational factors. Based on the test results, the contractor shall develop procedures of AAS using NAM, high volume air sampler, or both equipment at the same time in a confined area. For these tests, experimentation shall be carried out in accordance with the QAPP. Deviations from the QAPP shall be documented in writing and justified.

Task 3. Field Sampling

In Task 3, the contractor shall conduct field sampling using AAS, wet vacuum, and cleaning robot methods in a mock subway system at the Fort A.P. Hill, VA in September, 2016. The exact dates, field details, and sampling locations will be provided by the EPA WACOR. The contractor shall prepare all materials for three sampling methods for up to 5 sampling events. The

contractor shall prepare the written procedures for three sampling methods. The contractor shall calibrate, sterilize, and ship sampling equipment for field tests as needed. The samples from field measurements will be packaged and shipped to the EPA RTP laboratory for analysis.

Task 4. Report Preparation
In Task 4, the contractor shall prepare AAS procedures and a full report detailing the test results and lessons learned from the testing. The report shall follow the EPA report format. This report shall include documentation of the time required to complete each entire test procedure and all procedural steps. The report shall include any digital photos necessary to illustrate the findings. The draft report shall be submitted by the EPA WACOR for review from within EPA, including a Quality Assurance review. A final report incorporating requested changes, correction, and clarification resulting from the review process shall be submitted by the contractor within 15 days from receiving the official comments from the EPA WACOR. A separate document detailing the response to comments shall also be submitted to the EPA WACOR by the contractor with the final version of the report.

The results of all tasks shall be documented in one final report discussing sampling efficacy as a function of independent variables and operational factors associated with each removal method. A draft report shall be provided to the U.S. EPA Work Assignment Contracting Officer Representative (EPA WACOR) for review and comment. A final report incorporating comments from the EPA WACOR, and including a separate documentation of the disposition of comments, shall also be provided as the final deliverable on this work assignment. All products developed under this PWS (e.g., the above mentioned technical report) must conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

IX. DELIVERABLE SCHEDULE

QAPP Amendment
A draft QAPP and Work Plan shall be provided within 30 days of the award of this agreement. This shall be provided prior to commencement of the tests described within this PWS. The QAPP and Work Plan shall include scope, scheduling, and costing information for each of the tests planned.

Reporting
A Draft Report and procedures shall be provided to EPA for review by March 1, 2017. A final report shall be provided 10 business days after EPA comments.

X. X. RESPONSIBILITIES

This project is initiated by the USEPA Office of Research and Development, National Homeland Security Research Center (NHSRC), Decontamination and Consequence Management Division (DCMD) in Research Triangle Park, NC. This project is a collaborative effort with the US

Department of Homeland Security. The U.S. EPA WACOR shall be Dr. Sang Don Lee (phone 919-541-4531, email lee.sangdon@epa.gov). Dr. Worth Calfee shall be alternate WACOR.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-064

☐ Other ☒ Amendment Number: 000002

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base Option Period Number: 1

Title of Work Assignment/SF Site Name:

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: Section 1, 2, & 6

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:
The purpose of this amendment is to revise the PWS (changes are highlighted).

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Sangdon Lee	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-4531
			FAX Number:
Project Officer Name: Robin S. Harris	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-0955
			FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code:
			Phone Number:
			FAX Number:
Contracting Official Name: Candice Charlton	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-487-2007
			FAX Number:

PERFORMANCE WORK STATEMENT

Optimization of Critical Parameters for Aggressive Air Sampling

AMENDMENT 2~~H~~

PROJECT# HS 7.52.02-486

WORK ASSIGNMENT 1-064

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HOMELAND SECURITY RESEARCH CENTER
DECONTAMINATION AND CONSEQUENCE MANAGEMENT DIVISION

I. PERIOD OF PERFORMANCE 2
II. SUMMARY OF OBJECTIVES 2
III. RELEVANCE 2
IV. BACKGROUND 2
V. SCOPE ..... 3~~3~~
VI. TECHNICAL APPROACH ..... 3~~3~~
VII. FACILITIES AND MATERIALS ..... 3~~3~~
VIII. TASKS ..... 4~~4~~
IX. DELIVERABLE SCHEDULE ..... 5~~5~~
X. X. RESPONSIBILITIES ..... 6~~5~~

TITLE

Optimization of Critical Parameters for Aggressive Air Sampling

I. PERIOD OF PERFORMANCE

The period of performance for the work under this work assignment shall be April 1, 2016 through March 31, 2017.

II. SUMMARY OF OBJECTIVES

The goal of this work is to improve the aggressive air sampling (AAS) method for use in sampling *Bacillus anthracis* spores under various environmental conditions.

III. RELEVANCE

This project supports the mission of the Decontamination and Consequence Management Division (DCMD) within the U.S. Environmental Protection Agency's (U.S. EPA) National Homeland Security Research Center (NHSRC) by providing relevant information pertinent to the decontamination of contaminated areas resulting from an act of terrorism. The project supports the EPA's Homeland Security Research Program (HSRP) and the NHSRC's strategic goals as described in detail in the Homeland Security Research Multi-year Strategic Plan (draft, November 26, 2008). Specifically, the project is relevant to Long-Term Goal 2 (LTG-2) which states, "The Office of Land and Emergency Response (OLEM) and other clients use homeland security research program products and expertise to improve the capability to respond to terrorist attacks affecting buildings and the outdoor environments." This project addresses a direct need expressed by OLEM's CBRN Consequence Management Advisory Division (CMAT), regarding an understanding and optimizing composite-based sampling for a wide area anthrax incident. Due to the potential relevance of this project in preparing for the Federal response to wide-area anthrax incidents, this project will be managed by NHSRC with the support of a multidiscipline project team.

IV. BACKGROUND

In the event of a release of biological material in an urban area that would require decontamination for the purpose of public safety. In such an event, a wide range of surfaces would be contaminated. The Environmental Protection Agency (EPA) has the responsibility for protecting human health and the environment from these contaminated areas. Accurate measurements of residual contamination are needed to inform decisions on re-entry and reoccupation of spaces following site decontamination. For a wide area contamination incident, traditional surface sampling methods (i.e., wipe, swab and vacuum sock) used for clearance sampling may require an extensive number of samples, which may be time and labor intensive to achieve a reasonable confidence. Judgmental sampling is an alternate strategy which can reduce the total number of samples. However, statistical analyses of results from this sampling strategy are not applicable. Innovative techniques, such as Aggressive Air Sampling (AAS), may prove useful as an additional method to currently-used surface sampling methods and, with additional

research, may be used as an alternative method in certain situations (i.e., detection of spore presence from unknown hot spots, wide spread contamination with concentration close to detection limit for surface sampling methods, etc.), and effectively shorten the timeline to recovery and/or reduce the sampling burden during a response. AAS could be used for numerous building interiors for rapid sampling with fewer required personnel, and in certain scenarios such as covert wide area contamination, could reduce the total number of samples per unit area compared to the current surface sampling methods. Given that surface sampling is one of the critical bottlenecks in the remediation process, AAS could ultimately result in a decrease in overall cleanup time. Unlike surface sampling, AAS indicates airborne concentrations of respirable size particles that can be used to assess risk of inhalation exposure and as a result, risk of inhalation anthrax. Surface sampling does not differentiate particle size nor does it allow for determining the fraction of particles that could become re-aerosolized. The purpose of this Work Assignment is to help determine appropriate AAS procedures for Bacillus anthracis sampling. The U.S. Environmental Protection Agency (EPA)/National Homeland Security Research Center (NHSRC) will support this work.

V. SCOPE

The purpose of this project is to determine the effectiveness of AAS and other composite methods for sampling spores from subway surfaces including platform and rail surfaces under various environmental conditions.

VI. TECHNICAL APPROACH

Laboratory tests: a known quantity of *Bacillus* spores will be deposited by aerial dispersion onto large coupons fabricated to contain ballasts that can be commonly found from a subway rail system. The coupons will then be sampled using the Aggressive Air sampling method. AAS efficacy will be determined for varied environmental conditions according to culture-based microbiological assays developed by EPA and CDC. All test parameters, such as test chamber size, coupon materials and sizes, sampling methods, methods of extraction / analysis will be determined by agreement among the EPA project team.

Field tests: three different composite sampling methods, AAS, commercial wet vacuum, and cleaning robots, will be tested for their sampling effectiveness in a mock subway system located at the Fort A.P. Hill, VA during the joint exercise with Department of Homeland Security in September 2016. Three methods will be utilized to sample spores from subway surfaces after decontamination. The samples collected during the field tests will be analyzed according to culture-based microbiological assays developed by EPA and CDC.

VII. FACILITIES AND MATERIALS

All laboratory work on this project described in this performance work statement (PWS) shall be performed at the U.S. EPA's facilities located at 109 T.W. Alexander Dr., Research Triangle Park, NC. This study shall be conducted in B205.

The field tests on this project described in this PWS shall be performed at the Fort A.P. Hill, VA. The sample analyses shall be conducted in the Microbiology lab, located in E-386, E-388, and E-390 at the U.S. EPA's facilities located at 109 T.W. Alexander Dr., Research Triangle Park, NC.

VIII. TASKS

To achieve the desired objective of this effort, work for this PWS can be broken down into four tasks. These tasks are a continuation of the testing outlined in the QAPP developed during the previous option.

Task 1. QAPP Development

The contractor shall prepare a QAPP in accordance with Quality Assurance (QA) Category_B_. Attachment 1 to the PWS provides information regarding NHSRC QA Requirements/Definitions List.

QAPPs being developed for Category A (formerly Category 1 or 2) projects must be developed in accordance with the document titled "EPA Requirements for Quality Assurance Project Plans." EPA QA/R-5 can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf. At the discretion of the COR, a Category B (formerly category 3) QAPP can be developed based on the R5 guidance or a project-specific QA requirements provided on the NHSRC@work website.

The QAPP must be approved prior to the start of any literature searches (existing data), data collection, gathering, synthesizing, or data generation (laboratory) work. Additional information related to QA requirements can be found at www.epa.gov/quality.

Task 2. Laboratory Experimentation

In Task 2, the contractor shall conduct experiments to measure the sampling efficacy of AAS on ballast surfaces. All tests shall be conducted using the same test chamber in the QAPP, Identification of critical parameters for aggressive air sampling. The AAS efficacies on ballast surfaces will be measured as a function of relative humidity (30 vs. 85 RH %), decontamination agent application (fog and liquid), spore types (atrophaeus vs. Btk) and spore loadings (1E2 to 1E6 per ft2). The contractor shall conduct the laboratory testing to assess the use of Negative Air Machine (NAM) for AAS. The contractor shall amend the existing QAPP to include the test matrix for NAM evaluation. Tests will be designed to determine the necessary operational conditions to achieve the best sampling efficacy by using NAM. The test conditions will include NAM flow rate, filter type and size, NAM filter location, and any other operational factors. Based on the test results, the contractor shall develop procedures of AAS using NAM, high volume air sampler, or both equipment at the same time in a confined area. For these tests, experimentation shall be carried out in accordance with the QAPP. Deviations from the QAPP shall be documented in writing and justified.

Task 3. Field Sampling

In Task 3, the contractor shall conduct field sampling using AAS, wet vacuum, and cleaning robot methods in a mock subway system at the Fort A.P. Hill, VA in September, 2016. The exact dates, field details, and sampling locations will be provided by the EPA WACOR. The contractor shall prepare all materials for three sampling methods for up to 5 sampling events. The

contractor shall prepare the written procedures for three sampling methods. The contractor shall calibrate, sterilize, and ship sampling equipment for field tests as needed. The samples from field measurements will be packaged and shipped to the EPA RTP laboratory for analysis. The Contractor shall analyze the results of DFU and NAM filters collected from two AAS tests at the field sampling event in September. The contractor shall analyze the impact of loaded filters on flow rates of DFUs during AAS. The contractor shall analyze the Aerodynamic Particle Sizer data provided by EPA and compare the results to the filter data collected during the field sampling event.

Task 4. Report Preparation

In Task 4, the contractor shall prepare AAS procedures and a full report detailing the test results and lessons learned from the testing. The report shall follow the EPA report format. This report shall include documentation of the time required to complete each entire test procedure and all procedural steps. The report shall include any digital photos necessary to illustrate the findings. The draft report shall be submitted by the EPA WACOR for review from within EPA, including a Quality Assurance review. A final report incorporating requested changes, correction, and clarification resulting from the review process shall be submitted by the contractor within 15 days from receiving the official comments from the EPA WACOR. A separate document detailing the response to comments shall also be submitted to the EPA WACOR by the contractor with the final version of the report.

The results of all tasks shall be documented in one final report discussing sampling efficacy as a function of independent variables and operational factors associated with each removal method. A draft report shall be provided to the U.S. EPA Work Assignment Contracting Officer Representative (EPA WACOR) for review and comment. A final report incorporating comments from the EPA WACOR, and including a separate documentation of the disposition of comments, shall also be provided as the final deliverable on this work assignment. All products developed under this PWS (e.g., the above mentioned technical report) must conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

IX. DELIVERABLE SCHEDULE

QAPP Amendment

A draft QAPP and Work Plan shall be provided within 30 days of the award of this agreement. This shall be provided prior to commencement of the tests described within this PWS. The QAPP and Work Plan shall include scope, scheduling, and costing information for each of the tests planned.

Reporting

A Draft Report and procedures shall be provided to EPA for review by March 1, 2017. A final report shall be provided 10 business days after EPA comments.

X. X. RESPONSIBILITIES

This project is initiated by the USEPA Office of Research and Development, National Homeland Security Research Center (NHSRC), Decontamination and Consequence Management Division (DCMD) in Research Triangle Park, NC. This project is a collaborative effort with the US Department of Homeland Security. The U.S. EPA WACOR shall be Dr. Sang Don Lee (phone 919-541-4531, email lee.sangdon@epa.gov). Dr. Worth Calfee shall be alternate WACOR.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-066

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Sangdon Lee
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-4531
FAX Number:

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

PERFORMANCE WORK STATEMENT

Development of a Vacuum-based Biological Agent All Surface Sampler

PROJECT# HS 7.52.02-544

WORK ASSIGNMENT 1-066

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HOMELAND SECURITY RESEARCH CENTER
DECONTAMINATION AND CONSEQUENCE MANAGEMENT DIVISION

I. PERIOD OF PERFORMANCE 2
II. SUMMARY OF OBJECTIVES 2
III. RELEVANCE 2
IV. BACKGROUND 2
V. SCOPE 3
VI. TECHNICAL APPROACH 3
VII. FACILITIES AND MATERIALS 3
VIII. TASKS 4
IX. DELIVERABLE SCHEDULE 5
X. RESPONSIBILITIES 5

TITLE

Development of a Vacuum-based Biological Agent All Surface Sampler

I. PERIOD OF PERFORMANCE

The period of performance for the work under this work assignment shall be April 1, 2016 through March 31, 2017.

II. SUMMARY OF OBJECTIVES

The proposed work will evaluate options for developing a sampling device that can be used universally on porous and non-porous surface types for collection biological agents. Options for the proposed work include the development of a new surface sampling device that is vacuum-based and includes a liquid dispenser or the development of a new sampling nozzle as described above to augment a Commercial off the Shelf device. The ultimate object is to develop a surface sampling device that can be applied to any surface type and could therefore be used in place of all existing devices and methods during the response to a biological incident. Scientifically-testing sampling methods will provide increased confidence in the ability to characterize contamination following such an event.

III. RELEVANCE

This project supports the mission of the Decontamination and Consequence Management Division (DCMD) within the U.S. Environmental Protection Agency's (U.S. EPA) National Homeland Security Research Center (NHSRC) by providing relevant information pertinent to the decontamination of contaminated areas resulting from an act of terrorism. The project supports the EPA's Homeland Security Research Program (HSRP) and the NHSRC's strategic goals as described in detail in the Homeland Security Research Multi-year Strategic Plan (draft, November 26, 2008). Specifically, the project is relevant to Long-Term Goal 2 (LTG-2) which states, "The Office of Land and Emergency Management (OLEM) and other clients use homeland security research program products and expertise to improve the capability to respond to terrorist attacks affecting buildings and the outdoor environments." This project addresses a direct need expressed by OLEM's CBRN Consequence Management Advisory Division (CMAD), regarding an understanding and optimizing composite-based sampling for a wide area anthrax incident. Due to the potential relevance of this project in preparing for the Federal response to wide-area anthrax incidents, this project will be managed by NHSRC with the support of a multidiscipline project team.

IV. BACKGROUND

The product from this work will significantly decrease surface sample collection and analysis time. Currently, there are three surface sampling devices used for biological agents including swabs, wipes, and vacuums fitted with filter-type collection media. Operationally and logistically it is challenging to prepare and utilize these three different collection methods. Furthermore, total sample collection efficiency for each of the three methods range from 12 to 40%. The new sampling device will be operationally and logistically more efficient and total sample collection efficiencies are expected to be higher than existing devices. For the swabs, wipes and vacuums;

laboratory processing includes removing the biological agent from the sampling media. During this processing there are agent losses due to inefficiencies. The developed device will not require post-collection processing, as agents are captured directly into a liquid that can be analyzed. As such, the developed method will likely have higher recovery efficiencies than the existing methods. The results of this work will be made available through published reports, journal papers, and/or conference abstracts and presentations.

V. SCOPE

Prototype sampling instruments or alterations to existing sampling equipment shall be made according to input from the Project Team, consisting of members of EPA's Office of Emergency Management, and EPA's Office of Research and Development. The test will determine the proper sampling liquid, liquid amount and sampling procedure. Commercially available devices or laboratory developed and modified sampling devices will be evaluated for collection efficiency through a set of controlled tests. For example, a known quantity of *Bacillus* spores will be deposited by aerial dispersion onto large coupons (1 $ft.^2$ or greater), constructed of a relevant material type (i.e., carpet). The coupons will then be subjected to vacuum-based sampling, using the device of interest. Recovery will be determined for each sampling device according to culture-based microbiological assays. All test parameters, such as test chamber size, coupon materials and sizes, sampling methods, methods of extraction / analysis will be determined by agreement among participating experts mentioned previously.

VI. TECHNICAL APPROACH

A known quantity of *Bacillus* spores will be deposited by aerial dispersion onto large floor surface coupons (1 ft^2) that can be commonly found in an indoor environment. The coupons will then be sampled using commercially available wet vacuums. Sampling efficacy will be determined for varied wet vacuum types according to culture-based microbiological assays developed by EPA and CDC. All test parameters, such as test chamber size, coupon materials and sizes, sampling methods, methods of extraction / analysis will be determined by agreement among the EPA project team. Based on the test results, the sampling procedure will be developed and demonstrated under various scenarios.

VII. FACILITIES AND MATERIALS

All tasks described in this SOW shall be performed in-house, at the EPA's Research Triangle Park (RTP) facilities at 109 T.W. Alexander Dr., unless approved otherwise by the EPA WACOR. The sampling activities shall be conducted in the NHSRC's Decontamination Technologies Research Lab (DTRL) located in H-224, H-222, H-122a, and H-130a. The lab contains the necessary equipment for the tasks described herein. The analysis of the biological samples shall be conducted in the Microbiology lab, located in E-386, E-388, and E-390.

VIII. TASKS

The contractor shall provide the personnel, equipment, materials, and supplies necessary to perform the following Work Assignment for development of a biological surface sampling device. This Work Assignment is written such that there are options in which this task can be accomplished. Test parameters shall be consulted with the EPA WACOR prior to develop a QAPP.

Task 1. QAPP Development

The contractor shall prepare a QAPP in accordance with Quality Assurance (QA) Category_B_. Attachment 1 to the PWS provides information regarding NHSRC QA Requirements/Definitions List.

QAPPs being developed for Category A (formerly Category 1 or 2) projects must be developed in accordance with the document titled "EPA Requirements for Quality Assurance Project Plans." EPA QA/R-5 can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf. At the discretion of the COR, a Category B (formerly category 3) QAPP can be developed based on the R5 guidance or a project-specific QA requirements provided on the NHSRC@work website.

The QAPP must be approved prior to the start of any literature searches (existing data), data collection, gathering, synthesizing, or data generation (laboratory) work. Additional information related to QA requirements can be found at www.epa.gov/quality.

Task 2. Laboratory Experimentation

The evaluation will be conducted based on the findings from the previous work under EP-C-15-008 WA 0-66. The findings include liquid type, liquid volume, and temporal lapse between liquid application and liquid collection (suction). The evaluation will be conducted by comparing sampling efficacies of aerosol deposited *Bacillus* spores between the commercial products and the currently-used sampling methods on various surfaces. The surfaces will include concrete, carpet, tile, laminate, glass, etc. Three different spore loadings will be used for evaluation. The spore loadings will vary from 10^2 to 10^7 CFUs per ft^2. The contractor shall take digital photos and videos of test procedures.

Task 3. Sampling Procedure Development and Demonstration

The Contractor shall set up laboratory tests to evaluate cross contamination during the developed SOP steps. The evaluation may be conducted with tracer material such as fluorescent particles for easy detection. If cross contamination occurs, the Contractor shall optimize the identified steps for prevention. The Contractor shall record the test steps in videos and photos.

The Contractor shall conduct the demonstrations using the optimized procedure to evaluate the wet vacuum usability in various sampling scenarios. The scenarios shall be at least 5 but less than 20. The demonstration locations, including but not limited to office, auditorium, living room, bathroom, and kitchen, will be selected with considerations of usability of the RTP facilities. The detail scenarios will be consulted with the EPA WACOR. The sampling procedure will be revised based on the outcomes from each demonstration. Following each revision of the procedure, the demonstration shall be repeated. For these demonstrations, the procedures shall be carried out in accordance with the QAPP. Deviations from the QAPP shall

be documented in writing and justified. The Contractor shall record the test steps in videos and photos.

Task 4. Report Preparation
In Task 4, the contractor shall prepare a full report detailing the test results and lessons learned from the testing. The report shall follow the EPA report format. This report shall include documentation of the time required to complete each entire test procedure and all procedural steps. The report shall include any digital photos necessary to illustrate the findings. The draft report shall be submitted by the EPA WACOR for review from within EPA, including a Quality Assurance review. A final report incorporating requested changes, correction, and clarification resulting from the review process shall be submitted by the contractor within 15 days from receiving the official comments from the EPA WACOR. A separate document detailing the response to comments shall also be submitted to the EPA WACOR by the contractor with the final version of the report.

The results of all tasks shall be documented in one final report discussing sampling efficacy as a function of independent variables and operational factors associated with each removal method. A draft report shall be provided to the U.S. EPA Work Assignment Contracting Officer Representative (EPA WACOR) for review and comment. A final report incorporating comments from the EPA WACOR, and including a separate documentation of the disposition of comments, shall also be provided as the final deliverable on this work assignment. All products developed under this PWS (e.g., the above mentioned technical report) must conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

IX. DELIVERABLE SCHEDULE

QAPP Amendment
A draft QAPP and Work Plan shall be provided within 30 days of the award of this agreement. This shall be provided prior to commencement of the tests described within this PWS. The QAPP and Work Plan shall include scope, scheduling, and costing information for each of the tests planned.

Reporting
A Draft Report shall be provided to EPA for review by March 1, 2017. A final report shall be provided 10 business days after EPA comments.

X. RESPONSIBILITIES

This project is initiated by the USEPA Office of Research and Development, National Homeland Security Research Center (NHSRC), Decontamination and Consequence Management Division (DCMD) in Research Triangle Park, NC. This project is a collaborative effort with the US Department of Homeland Security. The U.S. EPA WACOR shall be Dr. Sang Don Lee (phone 919-541-4531, email lee.sangdon@epa.gov). Dr. Worth Calfee shall be alternate WACOR.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-066

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2016
Base Option Period Number 1

Title of Work Assignment/SF Site Name: Amendment 1

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Sangdon Lee
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-4531
FAX Number:

Project Officer Name Robin S. Harris
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0955
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

PERFORMANCE WORK STATEMENT

Development of a Vacuum-based Biological Agent All Surface Sampler

PROJECT# HS 7.52.02-544

WORK ASSIGNMENT 1-066

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HOMELAND SECURITY RESEARCH CENTER
DECONTAMINATION AND CONSEQUENCE MANAGEMENT DIVISION

I. PERIOD OF PERFORMANCE 2
II. SUMMARY OF OBJECTIVES 2
III. RELEVANCE 2
IV. BACKGROUND 2
V. SCOPE ..... 3~~3~~
VI. TECHNICAL APPROACH ..... 3~~3~~
VII. FACILITIES AND MATERIALS ..... 3~~3~~
VIII. TASKS ..... 4~~4~~
IX. DELIVERABLE SCHEDULE ..... 6~~5~~
X. RESPONSIBILITIES ..... 6~~5~~

TITLE

Development of a Vacuum-based Biological Agent All Surface Sampler

I. PERIOD OF PERFORMANCE

The period of performance for the work under this work assignment shall be April 1, 2016 through March 31, 2017.

II. SUMMARY OF OBJECTIVES

The proposed work will evaluate options for developing a sampling device that can be used universally on porous and non-porous surface types for collection biological agents. Options for the proposed work include the development of a new surface sampling device that is vacuum-based and includes a liquid dispenser or the development of a new sampling nozzle as described above to augment a Commercial off the Shelf device. The ultimate object is to develop a surface sampling device that can be applied to any surface type and could therefore be used in place of all existing devices and methods during the response to a biological incident. Scientifically-testing sampling methods will provide increased confidence in the ability to characterize contamination following such an event.

III. RELEVANCE

This project supports the mission of the Decontamination and Consequence Management Division (DCMD) within the U.S. Environmental Protection Agency's (U.S. EPA) National Homeland Security Research Center (NHSRC) by providing relevant information pertinent to the decontamination of contaminated areas resulting from an act of terrorism. The project supports the EPA's Homeland Security Research Program (HSRP) and the NHSRC's strategic goals as described in detail in the Homeland Security Research Multi-year Strategic Plan (draft, November 26, 2008). Specifically, the project is relevant to Long-Term Goal 2 (LTG-2) which states, "The Office of Land and Emergency Management (OLEM) and other clients use homeland security research program products and expertise to improve the capability to respond to terrorist attacks affecting buildings and the outdoor environments." This project addresses a direct need expressed by OLEM's CBRN Consequence Management Advisory Division (CMAD), regarding an understanding and optimizing composite-based sampling for a wide area anthrax incident. Due to the potential relevance of this project in preparing for the Federal response to wide-area anthrax incidents, this project will be managed by NHSRC with the support of a multidiscipline project team.

IV. BACKGROUND

The product from this work will significantly decrease surface sample collection and analysis time. Currently, there are three surface sampling devices used for biological agents including swabs, wipes, and vacuums fitted with filter-type collection media. Operationally and logistically it is challenging to prepare and utilize these three different collection methods. Furthermore, total sample collection efficiency for each of the three methods range from 12 to 40%. The new sampling device will be operationally and logistically more efficient and total sample collection efficiencies are expected to be higher than existing devices. For the swabs, wipes and vacuums;

laboratory processing includes removing the biological agent from the sampling media. During this processing there are agent losses due to inefficiencies. The developed device will not require post-collection processing, as agents are captured directly into a liquid that can be analyzed. As such, the developed method will likely have higher recovery efficiencies than the existing methods. The results of this work will be made available through published reports, journal papers, and/or conference abstracts and presentations.

V. SCOPE

Prototype sampling instruments or alterations to existing sampling equipment shall be made according to input from the Project Team, consisting of members of EPA's Office of Emergency Management, and EPA's Office of Research and Development. The test will determine the proper sampling liquid, liquid amount and sampling procedure. Commercially available devices or laboratory developed and modified sampling devices will be evaluated for collection efficiency through a set of controlled tests. For example, a known quantity of *Bacillus* spores will be deposited by aerial dispersion onto large coupons (1 $ft.^2$ or greater), constructed of a relevant material type (i.e., carpet). The coupons will then be subjected to vacuum-based sampling, using the device of interest. Recovery will be determined for each sampling device according to culture-based microbiological assays. All test parameters, such as test chamber size, coupon materials and sizes, sampling methods, methods of extraction / analysis will be determined by agreement among participating experts mentioned previously.

VI. TECHNICAL APPROACH

A known quantity of *Bacillus* spores will be deposited by aerial dispersion onto large floor surface coupons (1 ft^2) that can be commonly found in an indoor environment. The coupons will then be sampled using commercially available wet vacuums. Sampling efficacy will be determined for varied wet vacuum types according to culture-based microbiological assays developed by EPA and CDC. All test parameters, such as test chamber size, coupon materials and sizes, sampling methods, methods of extraction / analysis will be determined by agreement among the EPA project team. Based on the test results, the sampling procedure will be developed and demonstrated under various scenarios.

VII. FACILITIES AND MATERIALS

All tasks described in this SOW shall be performed in-house, at the EPA's Research Triangle Park (RTP) facilities at 109 T.W. Alexander Dr., unless approved otherwise by the EPA WACOR. The sampling activities shall be conducted in the NHSRC's Decontamination Technologies Research Lab (DTRL) located in H-224, H-222, H-122a, and H-130a. The lab contains the necessary equipment for the tasks described herein. The analysis of the biological samples shall be conducted in the Microbiology lab, located in E-386, E-388, and E-390.

VIII. TASKS

The contractor shall provide the personnel, equipment, materials, and supplies necessary to perform the following Work Assignment for development of a biological surface sampling device. This Work Assignment is written such that there are options in which this task can be accomplished. Test parameters shall be consulted with the EPA WACOR prior to develop a QAPP.

Task 1. QAPP Development

The contractor shall prepare a QAPP in accordance with Quality Assurance (QA) Category_B_. Attachment 1 to the PWS provides information regarding NHSRC QA Requirements/Definitions List.

QAPPs being developed for Category A (formerly Category 1 or 2) projects must be developed in accordance with the document titled "EPA Requirements for Quality Assurance Project Plans." EPA QA/R-5 can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf. At the discretion of the COR, a Category B (formerly category 3) QAPP can be developed based on the R5 guidance or a project-specific QA requirements provided on the NHSRC@work website.

The QAPP must be approved prior to the start of any literature searches (existing data), data collection, gathering, synthesizing, or data generation (laboratory) work. Additional information related to QA requirements can be found at www.epa.gov/quality.

Task 2. Laboratory Experimentation

The evaluation will be conducted based on the findings from the previous work under EP-C-15-008 WA 0-66. The findings include liquid type, liquid volume, and temporal lapse between liquid application and liquid collection (suction). The evaluation will be conducted by comparing sampling efficacies of aerosol deposited *Bacillus* spores between the commercial products and the currently-used sampling methods on various surfaces. The surfaces will include concrete, carpet, tile, laminate, glass, etc. Three different spore loadings will be used for evaluation. The spore loadings will vary from 10^2 to 10^7 CFUs per ft^2. The contractor shall take digital photos and videos of test procedures.

Task 3. Sampling Procedure Development and Demonstration

The Contractor shall set up laboratory tests to evaluate cross contamination during the developed SOP steps. The evaluation may be conducted with tracer material such as fluorescent particles for easy detection. If cross contamination occurs, the Contractor shall optimize the identified steps for prevention. The Contractor shall record the test steps in videos and photos.

The Contractor shall conduct the demonstrations using the optimized procedure to evaluate the wet vacuum usability in various sampling scenarios. The scenarios shall be at least 5 but less than 20. The demonstration locations, including but not limited to office, auditorium, living room, bathroom, and kitchen, will be selected with considerations of usability of the RTP facilities. The detail scenarios will be consulted with the EPA WACOR. The sampling procedure will be revised based on the outcomes from each demonstration. Following each revision of the procedure, the demonstration shall be repeated. For these demonstrations, the procedures shall be carried out in accordance with the QAPP. Deviations from the QAPP shall

be documented in writing and justified. The Contractor shall record the test steps in videos and photos.

Task 4. Report Preparation

In Task 4, the contractor shall prepare a full report detailing the test results and lessons learned from the testing. The report shall follow the EPA report format. This report shall include documentation of the time required to complete each entire test procedure and all procedural steps. The report shall include any digital photos necessary to illustrate the findings. The draft report shall be submitted by the EPA WACOR for review from within EPA, including a Quality Assurance review. A final report incorporating requested changes, correction, and clarification resulting from the review process shall be submitted by the contractor within 15 days from receiving the official comments from the EPA WACOR. A separate document detailing the response to comments shall also be submitted to the EPA WACOR by the contractor with the final version of the report.

The results of all tasks shall be documented in one final report discussing sampling efficacy as a function of independent variables and operational factors associated with each removal method. A draft report shall be provided to the U.S. EPA Work Assignment Contracting Officer Representative (EPA WACOR) for review and comment. A final report incorporating comments from the EPA WACOR, and including a separate documentation of the disposition of comments, shall also be provided as the final deliverable on this work assignment. All products developed under this PWS (e.g., the above mentioned technical report) must conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

NEW Task 5. Low Cost Fumigant Sensor Evaluation

Task 5.1: QAPP Development

The contractor shall prepare an amendment to an existing QAPP in accordance with Quality Assurance (QA) Category B. Attachment 1 to the Performance Work Statement (PWS) or Statement of Work (SOW) provides information regarding NHSRC QA Requirements/Definitions List.

The QAPP amendment must be approved prior to the start of any literature searches (existing data), data collection, gathering, synthesizing, or data generation (laboratory) work. Additional information related to QA requirements can be found at www.epa.gov/quality.

Task 5.2: Fumigant Sensor Evaluation

The contractor shall conduct low-cost sensor evaluation for three different fumigants, chlorine, chlorine dioxide, and hydrogen peroxide gases. The sensors, user manual and a computer will be provided by the EPA. The Contractor shall propose the evaluation methods to meet the criteria. The criteria will be provided by the EPA. The evaluation scope will include the following items, and further items and criteria may be provided by EPA based on results of initial testing:

1. Calibration curves of the sensors against the test levels of each fumigant at the constant temperature and RH (provide regression equation with slope and intercept)
2. Upper and Lower measurement limits that the sensors shall be able to monitor with the relative uncertainty (less than 50%) against indicative methods
3. Drifts during the exposure duration
4. Repeatability for 0, 50 and 80% of upper measurement limit
5. Variability of the sensor responses against temperature and relative humidity

Example evaluation conditions for fumigation are shown in the following table , which may be changed upon consultation with EPA based on initial test results.

Fumigant	Target concentration range (ppm)	Exposure duration (hrs)	Temperature range (°C)	RH range (%)
H_2O_2	0-500	6	10-30	40-90
ClO_2	0-1000	12	10-30	70-90
Cl_2	0-100	6	10-30	40-90

Task 5.3
The contractor shall deliver a data summary report describing results from Task 5.2.

IX. DELIVERABLE SCHEDULE

QAPP Amendment
A draft QAPP and Work Plan shall be provided within 30 days of the award of this agreement. This shall be provided prior to commencement of the tests described within this PWS. The QAPP and Work Plan shall include scope, scheduling, and costing information for each of the tests planned.

Reporting
A Draft Report shall be provided to EPA for review by March 1, 2017. A final report shall be provided 10 business days after EPA comments.

X. RESPONSIBILITIES

This project is initiated by the USEPA Office of Research and Development, National Homeland Security Research Center (NHSRC), Decontamination and Consequence Management Division (DCMD) in Research Triangle Park, NC. This project is a collaborative effort with the US Department of Homeland Security. The U.S. EPA WACOR shall be Dr. Sang Don Lee (phone 919-541-4531, email lee.sangdon@epa.gov). Dr. Worth Calfee shall be alternate WACOR.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-067

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Leroy Mickelsen
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-1356
FAX Number:

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

WORK ASSIGNMENT (WA)

1. Contractor: 0-067 2. Contract No.: EP-C-15-008

3. Contract Period: BASE 4. W.A. Number: 0-067

5. WA Amendment No: 0

6. W.A. Title:

Developing Table of Forces for Human Activity as it Relates to Reaerosolization and Exposure to Bacillus anthracis spores from Outdoor Urban Surfaces

7. Check Applicable Boxes ☒Original W.A. ☐ W.A. Amendment ☐ Work Plan Approval ☐ Other

8. WACOR:____Marshall Gray DCMD/NHSRC, MD E343-06 919-541-4303 919-541-0496
(Name, Branch/Division, Mail Code, Phone and Fax Numbers)

Alternate WACOR: : __Russell Wiener DCMD/NHSRC MD- D205-03 919-541-1910, 919-541-0496
(Name, Branch/Division, Mail Code, Phone and Fax Numbers)

NOTE: An Alternate WACOR must be nominated for each work assignment, or separate justification provided.

9. Est. Labor Hours 1240 Change ☒+/ ☐- Revised Total Hours

WP Approved CPFF Total $ 115000 Change ☒+/☐- Revised Total CPFF $

10. Completion Date March 31, 2016 Revised Completion Date

11. Relevant Contract SOW Sections: NHSRC Budget Task: HS 4.04.02-511

Introduction, sections: 1.7, 2.0, 3.0, 4.0, 5.4, 5.5

12. Comments:

WA: 0-067
WACOR: Marshall Gray

EP-C-15-008
Alt COR:

POP: April 1, 2016 through March 31, 2017

Developing Table of Forces for Human Activity as it Relates to Reaerosolization and Exposure to Bacillus anthracis spores from Outdoor Urban Surfaces

(A) *Goal/Purpose:* The goal of this work is to evaluate human activity and associated forces and their thresholds to initiate reaerosolization. This task will support the goals of the SPORE Program.

(B) *Background Information:* In the event of a release of biological material in an urban area that would require decontamination for the purpose of public safety, the potential of resuspension of said materials is of great interest to EPA and the Department of Homeland Security. In such an event, a wide range of surfaces would be contaminated. The Environmental Protection Agency (EPA) has the responsibility for protecting human health and the environment from secondary emission of materials from these areas. EPA may be required to mitigate, provide consequence management, and decontaminate the area of concern. To this end, the EPA Office of Research and Development (ORD) National Homeland Security Research Center (NHSRC), Decontamination and Consequence Management Division (DCMD) is conducting research to investigate the resuspension of surrogate spores in the Aerosol Test Facility (ATF).

Long-Term Goal 2: The Office of Solid Waste and Emergency Response and other clients use Homeland Security Research Program products and expertise to improve the capability to respond to terrorist attacks affecting buildings and the outdoor environment and APG (41) - The Homeland Security Research Program will deliver reports and databases with information on the movement and the health effects of contaminants form the basis of the need for this work.. The information is instrumental for containing contamination and mitigating health effects. Determination of the bacterial spore (Anthrax spore surrogates) resuspension efficiency is necessary based on the historic release of Anthrax by terrorists in the US and the lack of data demonstrating the ability of spores to resuspend in quantities of public health concern. There are gaps in understanding the influences of human activities as it related to reaerosolization. The purpose of this work assignment is to initiate research in this area. The U.S. Environmental Protection Agency (EPA)/National Homeland Security Research Center (NHSRC) will support this work Statement of Work (SOW).

Work will be conducted at EPA. Information obtained during this work will inform the following issues:

• understand the impact of human activities on reaerosolization.

(C) *Statement of Work/Tasks:* The Contractor shall:

A series of reports have be produced by EPA on prior studies to quantitate the resuspension of spores and other surrogates from common outdoor surfaces. A set of laboratory experiments has been completed studying the degree of resuspension of bar-coded BtK spores under a variety of test conditions. EPA wishes to continue and expand these experiments to study the influences of human activity as it relates to reaerosolization of spores from surfaces, ultimately to better understand human exposure. The methodologies to apply the spores and the data set for the forces required to resuspend spores from the test surfaces will be provided by EPA upon request. The specific surface types selected will be based on the results of the previous work done for EPA and will also be provided upon request. All prior reports and documentation for prior studies conducted for EPA will be made available to the contractor upon request.

Microbiological organisms, supplies, and analyses shall be conducted under a separate WA. Under the current WA, the contractor shall notify the EPA WAM of all microbiological tasks required for the completion of this work assignment as part of the Work Plan development process. Samples will be

delivered within the amount of time specified in the QAPP. The referenced documents attached below, available through the COR, will be utilized for biological sampling, quality assurance.

The Contractor shall provide a new table of deliverables and a timeline for the work to be performed within 30 days of the initiation of this Work Assignment.

Task 1: Task 1: Literature review on forces from human activity as it relates to reaerosolization thresholds:

The Contractor shall conduct a literature review regarding the influences of human activity as it relates to reaerosolization of spore. The Contractor shall identify research knowledge gaps in the quantitative estimation of risk posed by these activities. Provide the WACOR with a prioritized set of controlled tests to examine any knowledge gaps. The WACOR will make the determination on which, if any, tests to pursue. Note, the use of human subjects in research will require approvals by the EPA Institutional Research Board (IRB).

Date of Completion: August 31, 2015.

Task 2: Experimental design of controlled test:

The Contractor shall use barcoded Btk as the surrogate for Ba reaerosolization utilizing the methodology developed in in prior experiments conducted for EPA. Based upon the recommendation from the WACOR, the contractor shall provide an experimental design to address the reaerosolization of spores as it relates to human activities. Activities are anticipated to be associated with outdoor walking, running, yard work, bicycling, lawn mowing, leaf blowing, and other common outdoor activities. If IRB requirements are initiated due to the use of humans in research, the contractor shall complete required IRB training and submit required documents to the WACOR for presentation to the IRB.

Date of Completion: September 30, 2015.

Task 3. Conduct controlled tests:

Phase (1) The contractor shall, upon approval from the WACOR, (including QAPP, IRB (if applicable), etc. approval) execute controlled experiments to quantitatively measure the reaerosolization of spores from defined surfaces due to selected human activities as described in Task 2. Measurement shall include human breathing zone sampling to estimate exposure to spores during activities.

Date of Completion: February 28, 2016

Task 4: Data Analysis and Final Reporting:

The Contractor shall provide data analysis, statistical analysis of the data utilizing methods such as Anova and PCA to determine the key test parameters impacting spore resuspension and provide a final report.

Date of completion May 30, 2016.

The Contractor shall prepare monthly reports to EPA that will summarize the work activities (accomplished and planned) in this work assignment, including the status of applicable test, QA, and safety plans. The QAPP produced for prior studies by EPA may be utilized as a basis for the QAPP for this work assignment if applicable. The monthly report shall also detail labor costs and ODC charges. The ODC charges shall be documented in the report in a way that the items purchased, vendor, and cost are

clearly indicated.

(D) *Deliverables and Project Schedule, Acceptance Criteria:*

- Work Plan. A work plan containing a cost estimate shall be provided to the Contracting Officer (CO), PO and WACOR within 30 days of the Contracting Officer's signature. A Quality Assurance Project Plan (QAPP) shall be provided within 90 days. The Contractor shall develop a QAPP following the EPA Guidance for Quality Assurance Project Plans and Modeling (QA/G-5M) and Guidance for Quality Assurance Project Plans (QA/G-5) which can be found at http://www.epa.gov/quality/qa_docs.html. 2. A final report shall be provide to the WACOR on or before March 31, 2016.

(E) *QA/QC Requirements for WA:* Calibrations of scientific instruments shall be performed under existing Standard Operating Procedures. Standard "good laboratory practices" for maintaining notebooks shall be employed.

(F) *Special Requirements:* The contractor shall modify the work plan to cover all tasks through the WA end date. The hours and costs shall be broken down by tasks. The contractor shall modify the work plan to cover all tasks through the WA end date. The hours and costs shall be broken down by tasks. The contractor shall modify the QAPP in accordance with http://www.epa.gov/quality/qs-docs/r5-final.pdf or based on the additions to the research that is being conducted. For guidance on preparing a research-specific QAPP, the preparer should refer to the project specific requirements provided in NHSRC's QMP. The QAPP must be approved prior to the start of any laboratory work. Additional information related to QA requirements can be found at www.epa.gov/quality.

(G) *Reports and Meetings:*

Need	Meeting Purpose	Frequency
X	to discuss workplan	Once
X	to review data or analyses	Weekly
X	to review monthly cost report	Monthly

(H) *Travel/Training Requirements*: Travel ☐ is ☒ is not anticipated to be charged under this work assignment. If travel is anticipated, the dates and circumstances necessitating travel chargeable to this work assignment will be specified by Technical Directive. Travel will be reviewed and approved by the WACOR. Requests for travel shall include: (1) name of traveler(s) and job duties, (2) description of circumstances necessitating travel, (3) location of travel, and (4) estimated cost breakdown by categories

(I) *Management Controls*: See Contract Management Controls.

(J) *Staffing Requirements*:

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-068

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base X Option Period Number	1-068

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: All sections of 2

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Paul Lemieux	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-0962 FAX Number:
Project Officer Name Robin Baily	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:
Other Agency Official Name	(Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Mark Cranley	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Thermal Treatment of CBR Contaminants (HS 8.64.04-0420)

WA #: 1-068 **WACOR:** Paul Lemieux

Contract #: EP-C-15-008 **Alternate WACOR:** Sang Don Lee

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

The contractor shall provide support for operation, maintenance, sampling/analysis, and modification to the in-house rainbow furnace and rotary kiln incinerator simulator and tests to combust cesium-doped biomass in the rainbow furnace and/or rotary kiln incinerator simulator and acquire and analyze samples from those tests.

BACKGROUND

In the aftermath of a Radiological Dispersal Device (RDD) in an urban setting, there is the potential for the generation of significant quantities of contaminated biomass. These wastes are likely candidates for incineration as a means for volume reduction, due to the costs of disposal for Low Level Radioactive Waste (LLRW). Cesium (Cs), a metallic element, is a likely radionuclide that may be used in an RDD, and presents problematic behavior in combustion systems due to its volatility and solubility in water. Unlike organic compounds, combustion or incineration systems cannot destroy the elemental metal constituents, although high temperature combustion environments will induce metal transformations. These transformations are usually thought to exacerbate their harmful effects, since many of the metal species, including Cs, readily vaporize within combustion environments. Subsequently, this saturated vapor will nucleate and condense downstream of the flame, contributing to a fume of submicron aerosol. These particles, because of their small size, are difficult to collect in pollution control systems. Emissions of particulate-bound radioactive isotopes, such as 137Cs, from combustion systems, are highly undesirable. Moreover, chlorinated metal species that are collected often exhibit increased volatility, while chlorinated and sulfated metal species may exhibit increased water leachability.

The purpose of this research is to investigate biomass-bound Cs behavior, speciation, and transformations in combustion and incineration systems and examine methods and modifications to control Cs speciation and particle size distribution. One process of interest involves sorbent injection, whereby the high temperatures of practical incinerators might be exploited to transform Cs into constituents that are both more easily collected than Cs-containing effluents in the absence of combustion modifications.

Past work (Yoo et al., 2005; Lemieux et al., 2013) has shown that kaolinite, an alumino-silica sorbent can capture significant quantities of Cs fed into a combustion system. Experiments envisioned here will primarily use the rotary kiln incinerator, a pilot-scale 86 kW in-house research combustor. Cs will be continuously introduced into the kiln bound on biomass material, as bulk solids. Kaolinite will be injected along the centerline in the kiln's afterburner at a location based on the optimum temperature determined by Yoo et al. (2005). Measurements of both the submicron aerosol size distribution and the size segregated particulate composition in the exhaust will allow the effects of sorbent injection to be ascertained. The presence of other naturally occurring alkali metals (Na and K) and Cl will be evaluated for their propensities to interfere or preferentially react with the sorbent.

Previous testing was performed examining the combustion of cesium-containing biomass (corncob flour) in the Rainbow furnace, with the addition of sorbent to evaluate the sorbents' ability to capture cesium from the furnace flue gases. Based on analysis of the data, it was determined that it is necessary to run the test matrix using a different biomass (biomass pellets).

SCOPE

TECHNICAL APROACH/OBJECTIVES

Task 1) The contractor shall revise the existing QAPP as necessary to account for doing the experiments on the rotary kiln rather than the rainbow furnace.

Task 2) The contractor shall run additional cesium-contaminated biomass combustion experiments performed on the rotary kiln incinerator simulator in the same manner as previously performed (the WACOR will supply existing QAPPs and procedures as necessary). The following run conditions, shall be performed in triplicate, for a total of approximately 10 days of testing:

- Biomass pellets Alone
- Biomass pellets/Cesium
- Biomass pellets/Cesium/Sorbent

Additional elemental analysis of the sorbent material shall be performed using X-Ray Fluorescence (XRF). The ash shall also be analyzed for leachability of Cs once sorbed onto the sorbent materials.

Task 3) The contractor shall provide technical support, operating experience, analytical support, and expendable materials to conduct these tests using the EPA rainbow furnace and/or rotary kiln incinerator simulator. This support shall include:

- Provide expendable materials and building supplies to modify, operate, and maintain the rainbow furnace, or other in-house combustor, as appropriate.
- Provide engineering and operating labor for the design and execution of test plans on these furnaces.

- Maintain, calibrate, and operate monitoring equipment according to NRMRL/APPCD's Recommended Operating Procedures (ROPs) and instrument manuals.
- Collect and retain necessary operational data to ensure compliance EPA Safety, Health, and Environmental Management (SHEM) requirements.
- Make modification s to the rotary kiln's feeding apparatus for ground tires to be suitable for biomass pellets.

WA SPECIFIC EQUIPMENT

- Rotary Kiln Incinerator Simulator
- Rainbow Tunnel Furnace
- MOUDI Impactors

QUALITY ASSURANCE

Task 1 Preparation of the Quality Assurance Project Plan (QAPP)
The Contractor shall prepare a QAPP in accordance with Quality Assurance (QA) Category B. Attachment 1 to the Performance Work Statement (PWS) or Statement of Work (SOW) provides information regarding **NHSRC QA Requirements/Definitions List.**

QAPPs prepared for a Category B (formerly known as a Category 3 or 4) project must be developed in accordance with the document titled "EPA Requirements for Quality Assurance Project Plans." EPA QA/R-5 can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf and must be approved by an EPA Quality Assurance Manager (QAM) prior to the start of any literature searches (existing data), data collection, gathering, synthesizing, or data generation (laboratory) work.

At the discretion of the Contract Officer Representative (COR), a Category B QAPP may be based on the R5 guidance (described above) or a NHSRC project-specific QA requirements template provided as Attachment 2.

Additional information related to QA requirements can be found at www.epa.gov/quality.

DELIVERABLES

1. Planning Meetings: The WACOR and contractor's project manager shall arrange periodic project meetings to discuss Task-specific progress, issues, and action items.

2. Monthly Task Progress and Cost Reports: The Contractor's monthly report to EPA shall summarize work activities (accomplished and planned) in this work assignment, including the status of applicable test, QA, and safety plans. The monthly report shall also detail labor costs and ODC charges.

3. Health and Safety Research Protocols: Health and safety research protocols shall be prepared or updated as required by the EPA Facility and APPCD safety personnel. These protocols shall be approved by the WAM and safety personnel prior to the conduct of any testing.

4. Quality Assurance Project Plans (QAPPs): Existing QAPPs shall be updated as required by the EPA Facility and safety personnel. These protocols shall be approved by the WAM and safety personnel prior to the conduct of any testing. The contractor shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action. The contractor shall prepare a QAPP in accordance with http://www.epa.gov/quality/qs-docs/r5-final.pdf or based on the type of research that is being conducted. For guidance on preparing a research-specific QAPP, the preparer should refer to the project specific requirements provided in NHSRC's QMP. The QAPP must be approved prior to the start of any laboratory work. Additional information related to QA requirements can be found at www.epa.gov/quality.

5. Data Reports: The Contractor shall prepare data summaries and Quality Control data reports of all facility-specific data in lieu of an overall final report. Each Quality Control report shall be in a format suitable for EPA/NHSRC publication and shall discuss how well various measurements described in the QA plan were met.

SCHEDULE of DELIVERABLES

Task Progress and Cost Reports	Monthly
Health and Safety Research Protocols	Within 30 days of WA initiation
QAPP Revisions	Within 30 days of WA initiation

REFERENCES

Yoo, J., Shinagawa, T., Wood, J., Linak, W., Santoianni, D., King, C., Seo, Y., and J. Wendt, "High-Temperature Sorption of Cesium and Strontium on Dispersed Kaolinite Powders" Environ. Sci. Technol. 2005, 39, 5087-5094.

Lemieux, P., S. Lee, L. W., and C. Winterrowd, "Capture of Cesium During Biomass Combustion Using In-Furnace Sorbent Injection" in 2013 International Conference on Thermal Treatment Technologies and Hazardous Waste Combustors (IT3/HWC) 2013: San Antonio, TX.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-069

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017
Base Option Period Number 1

Title of Work Assignment/SF Site Name: WA 1-069

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Paul Lemieux
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0962
FAX Number:

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name:
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

STATEMENT OF WORK
Contract EP-C-15-008

PROJECT: HS 8.63.02
WORK ASSIGNMENT: 1-069

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HOMELAND SECURITY RESEARCH CENTER
DECONTAMINATION AND CONSEQUENCE MANAGEMENT DIVISION

I. TITLE

Remediation of Radioactively Contaminated Soils

II. PERIOD OF PERFORMANCE

The period of performance for the tasks detailed in this Statement of Work (SOW) shall be from April 1, 2016 to March 31, 2017.

III. SUMMARY OF OBJECTIVES

Particle size and activity measurements will be conducted to determine if radioactivity is associated with fine or coarse soil partitions. Various chemical methods will be tested for removal of radioactive contamination. These methods include: leaching, sedimentation, vibration, solvent extraction, flotation, and electrolytic remediation.

IV. BACKGROUND

It is estimated that the volume of contaminated material generated in a radiological dispersal device (RDD) could exceed the current capacity of all three of the licensed low-level radioactive waste disposal facilities. An accident on the scale of Fukushima Daiichi would increase these waste volumes even more. A significant fraction of the projected contaminated waste produced from cleanup of a wide-area radiological incident may be soil of various types depending on the location of the incident. Nationally, the Agency is challenged with large-scale radioactively contaminated projects related to phosphogypsum and uranium mine tailings. There are currently about 1 billion tons of phosphogypsum in Florida alone that are elevated in radium and cannot be used. In the Navajo Nation there are over 500 abandoned uranium mines as well as homes and drinking water sources with elevated levels of radiation.

The disposal of radioactively contaminated soils is limited to a handful of regulated disposal facilities nationwide. This accounts for a relatively high cost for disposal and transportation compared with other removals. Research is warranted to reduce the volume of soils during a cleanup to just those soils that exceed the cleanup standard, and to investigate soil treatment options to reduce the volume of contaminated soils. This research effort will also help any future large-scale contamination scenarios that create large volumes of waste.

Over the last few years Region 7 has conducted several removal actions at radium-contaminated sites and has developed a mobile soil screening technique to rapidly analyze soil samples and to help reduce the disposal of clean soils during a cleanup. Research in the screening and treatment of radium, uranium and thorium in soils can potentially reduce the cost and offer remedial alternatives for these projects.

The specific research proposal would focus on radioactive measurement, soil properties, and chemical/mineral extraction of radium, uranium and thorium from background soils that contain different levels of natural radioactivity, i.e. clay and shale.

V. SCOPE

The scope of this Work Assignment (WA) is to perform a series of bench-scale experiments.

VI. TECHNICAL APPROACH

The technical approach in this WA is to study the soil samples and then conduct a series of physical and chemical methods to remove the radium, uranium, and thorium from the soil samples.

VII. AFFORDABILITY

In comparison to the labor costs, only a minimal amount of expendable materials are required to be purchased by the contractor.

VIII. TECHNICAL RISK

The technical risk involved in this project is considered to be moderate. These methods have been tested in the laboratory to some extent but not under these conditions. All information obtained is expected to be relevant.

IX. FACILITIES AND MATERIALS

All work on this project described in this statement of work shall be performed at the U.S. EPA's facilities located at 109 TW Alexander Dr, Research Triangle Park, NC. Testing is anticipated to be performed in a High Bay Building Room 234.

X. TASKS

The contractor shall perform the following tasks as part of this work assignment:

TASK 1. COMPLETION OF QAPP

The contractor shall complete the previous incomplete draft of the quality assurance project plan and get it approved so experiments can begin.

TASK 2. CHEMICAL TREATMENT EXPERIMENT

The contractor shall perform a series of experiments using 20 g samples of the previously acquired soil, to evaluate the ability of different chemical treatments to remove the radium from the soil. A proposed test matrix is shown below.

Temperature		Chelator	Duration	
Ambient	pH 4 w/HCl	None	<1 h	Triplicate
Ambient	pH 4 w/HCl	2.94 g trisodium citrate dihydrate	72 h	Triplicate
Ambient	No Adjustment	2.94 g trisodium citrate dihydrate	72 h	Triplicate
Ambient	1.48 g Ca(OH)2	2.94 g trisodium citrate dihydrate	72 h	Triplicate
Ambient	pH 4 w/HCl	4.08 g tetrasodium tetrametaphosphate	72 h	Triplicate
Ambient	No Adjustment	4.08 g tetrasodium tetrametaphosphate	72 h	Triplicate
Ambient	1.48 g Ca(OH)2	4.08 g tetrasodium tetrametaphosphate	72 h	Triplicate
60 C	pH 4 w/HCl	2.94 g trisodium citrate dihydrate	6 h	single
60 C	1.48 g Ca(OH)2	4.08 g tetrasodium tetrametaphosphate	6 h	single

TASK 3. RADIATION SAFETY SUPPORT

The contractor shall assist EPA personnel conducting the activity measurements by providing laboratory radiation survey assistance.

XI. DELIVERABLE SCHEDULE

On a monthly basis for the duration of the project, the contractor shall submit, in electronic format, progress reports summarizing technical progress (including estimated percent of project completed), problems encountered, cumulative financial expenditures and cost and schedule variance. The contractor shall also have bi-weekly meetings with the EPA WAM and the project team for the duration of the WA.

The deliverables in the form of experimental details and samples are shown in Table 1.

Table 1: Deliverable Schedule

Task Number	Deliverable	Due Date
1	Revised QAPP Suitable for EPA final review and concurrence	2 week from award
2	Generation of Samples	2 months from approval of QAPP

XII. REPORTING REQUIREMENTS

- Data related to this project shall be stored on the US EPA server's "DTRL" shared drive.
- Transfer of project data shall occur at the conclusion of each experiment within each task. Detailed written summaries of experimental procedures and results shall be provided to the WAM within one week from completion of the data analysis. These reports shall indicate the operational conditions (e.g., decontamination solution preparation procedure and exposure time)

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-071

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Lukas Oudejans
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-2973
FAX Number:

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Operational testing of Swiffer wipes for household bioremediation

WA #: 1-071 WACOR: Lukas Oudejans

Contract #: EP-C-15-008 Alternate WACOR: Sang Don Lee

NHSRC Project Number: HS 8.63.02-0098

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be April 1, 2016 through March 31, 2017.

1. SUMMARY OF OBJECTIVES

This work will evaluate the use of dust sweepers to remove Bacillus anthracis surrogate spores from hard, nonporous floor materials as a low-tech activity to reduce overall exposure. This work will also assess whether unintentional exposure may occur due to reaerosolization of spores during this surface cleaning process.

2. BACKGROUND

EPA's Homeland Security Research Plan recognizes that the environmental cleanup following a chemical, biological, or radiological event involves an interconnected system of activities that require coordinated efforts to optimize cleanup effectiveness, minimize cost and recovery time, and reduce unintended consequences. Currently, EPA's National Homeland Security Research Center (NHSRC) is evaluating decontamination technologies against B. anthracis as part of remediation operations. Following a wide area anthrax spore release, it is likely that home owners at the edge of an evacuation zone may consider taking self-help actions that would reduce their indoor exposure risk. Self-help actions may include efforts to transfer biological spores from indoor surfaces by vacuuming or dust sweeping. Floor sweepers such as the Swiffer® Sweeper were evaluated under the previous option period on its use to remove spores from flooring materials. The results of this work could potentially inform self-help recommendations for the general public after a biological event.

3. SCOPE

This work assignment will finalize the work conducted under WA 0-071 during which the effectiveness of dusting hard surface floors to remove spores was measured.

4. TECHNICAL APROACH

The contractor shall provide the personnel necessary to perform the following Work Assignment tasks. At this time, no new research will be conducted. A QAPP entitled "Operational Testing of Swiffer Wipes for Household Bioremediation" was developed and approved under previous WA 0-071 on January 7, 2016. Hence, there is no need to prepare a QAPP and/or QAPP amendment.

Task 1: Test Report

The contractor shall generate a draft technical report (Draft I) detailing the test results and lessons learned from the testing under WA 0-071. This report shall include all procedural steps and any digital photos necessary to illustrate the findings. This Draft I version will be reviewed by the EPA WAM and EPA product team.

A second version (Draft II) of the report that incorporates the requested changes, corrections, and clarifications shall be submitted by the contractor following receipt of the combined comments from the EPA WAM and EPA product team. This draft report (Draft II) will be submitted by the EPA WAM for EPA peer reviews and Quality Assurance (QA) review.

A final report incorporating requested changes, correction, and clarification resulting from the EPA review process shall be submitted by the contractor. A separate document detailing the response to EPA QA comments shall also be submitted to the EPA WAM by the contractor with the final version of the report.

5. QUALITY ASSURANCE

A QAPP entitled "Operational Testing of Swiffer Wipes for Household Bioremediation" was developed and approved under previous WA 0-071 on January 7, 2016.

6. DELIVERABLES

1. The contractor shall have biweekly meetings with the EPA WAM to discuss any technical difficulties and report progress.

2. The contractor shall deliver two draft versions of the report and one final version according per the schedule of deliverables

7. SCHEDULE of DELIVERABLES

Table 1: Delivery Schedule

Deliverable	Due Date
Biweekly research meetings	N/A
Technical Report on Swiffer dusting operations- Draft version I	May 30, 2016
Technical Report on Swiffer dusting operations- Draft version II	Within 15 days from receipt of combined comments from EPA WAM and EPA Product Team
Technical Report on Swiffer dusting operations- Final version	Within 15 days from receipt of EPA peer and QA review comments and no later than August 31, 2016

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-072

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base X Option Period Number	1-072

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 1, 2, 5

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Lukas Oudejans	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-2973 FAX Number:
Project Officer Name Robin Baily	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Mark Cranley	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Impact of surface dirt & grime on use of bleach for bio decon

WA #: 1-072 WACOR: Lukas Oudejans

Contract #: EP-C-15-008 Alternate WACOR: Worth Calfee

NHSRC Project Number: HS8.63.02-0123

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from April 1, 2016 through March 31, 2017.

1. SUMMARY OF OBJECTIVES

This work will evaluate the impact of dirt and grime as present on subway building materials and exteriors of subway car materials have on the efficacy of pH amended bleach (pAB). This will be assessed through measurement of residual amounts of spores on surfaces and in effluent. This assessment will also include optimization of the bleach application to decontaminate ballast material (crushed rock).

2. BACKGROUND

In the event of a chemical/biological incident in a transportation hub like a subway system, remediation may require the use of various decontamination approaches ranging from volumetric decontamination by fumigation to surface decontamination using readily available decontamination products such as bleach. Previous (EPA-NHSRC) studies have shown that sporicidal solutions like pH amended bleach can be highly efficacious. Limited data exist on the impact of "dirt and grime" to the efficacy of pAB. A recent report [1] looked into the impact of a light dirt and grime loading. This study will continue to build on that report by investigating the efficacy of pAB and pAB with surfactant when used to decontaminate heavily grimed surfaces as frequently encountered in a subway system. The study will also investigate the fate and transport of spores through (grimed) ballast material.

3. SCOPE

This study will determine whether heavily grimed surfaces can be decontaminated using pAB as per previously identified spray procedures or whether additional steps are required.

4. TECHNICAL APROACH/OBJECTIVES

The overall technical direction follows approaches established under previous onsite contracts including the step by step application of bleach solution by sprayer. For each test, the effort shall include recovery of viable spores from the subway material and from effluent during each of the application steps. Each test point will consist of three test coupons and three positive controls that are contaminated but are not to be decontaminated. Test and analytical methods shall be adopted from existing standard operating procedures (SOPs) in consultation with the EPA work assignment manager (WAM).

The contractor shall perform the following tasks as part of this work assignment. All microbiological preparation and analyses will be covered under the concurrent onsite Biolab work assignment on this contract. The outcomes of this study will tie in to the scheduled Operational Technology Demonstration (OTD) led by EPA as sponsored by the Department of Homeland Security's Underground Transport Restoration (UTR) Program. This OTD is scheduled for September/October 2016. Therefore, tasks identified below shall be completed before August 1, 2016

Task 1: Preparation of the Quality Assurance Project Plan (QAPP)

The contractor shall prepare a QAPP in accordance with Quality Assurance (QA) **Category 3**. Attachment 1 to the Performance Work Statement (PWS) or Statement of Work (SOW) provides information regarding NHSRC QA Requirements/Definitions List.

A Category 1 or 2 QAPP must be developed in accordance with the document titled "EPA Requirements for Quality Assurance Project Plans." EPA QA/R-5 can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf. At the discretion of the COR, a Category 3 QAPP can be either based on the R5 guidance or a project-specific QA requirements provided on the NHSRC@work website. *The appropriate project-specific QA requirement information must be provided by the COR as Attachment 2.*

The **QAPP** must be approved prior to the start of any literature searches (existing data), data collection, gathering, synthesizing, or data generation (laboratory) work. Additional information related to QA requirements can be found at www.epa.gov/quality.

At the time of the writing of this PWS, a QAPP was under development by the contractor under the BASE option of this contract. Task 1 may therefore not be required if the QAPP has been approved by EPA. The contractor shall prepare amendments to the QAPP as applicable.

TASK 2. SUBWAY SURFACE SAMPLE PREPARATION

Building materials:

The subway building materials samples are expected to be highly irregular in shape and size, including a large variety in thickness. The contractor shall assess the inventory of subway material samples as provided by US EPA. Irregular shaped coupons shall be cut into square coupons in consultation with the EPA WAM. About half of the coupons (exact number to be determined in consultation with EPA WAM) shall undergo a cleaning procedure which will be provided by the EPA WAM. This procedure is derived from the procedures used by New York City (NYC) Metropolitan Transportation Authority (MTA) for cleaning in subways.

Ballast:

The contractor shall determine the type of ballast material as provided by the EPA WAM. The contractor shall fabricate crates of 12"x12'x12" into which ballast is added. Two removable coarse mesh screens shall be included to create three, approximately 4" thick, ballast layers.

TASK 3. SUBWAY GRIME CHARACTERIZATION

The contractor shall characterize (1) grime as provided by EPA as extracted from a subway car undercarriage and (2) the intended grime formulation [1] that shall be applied to the materials. Characterization shall include a determination of properties such organic carbon content, metal and metal oxides content.

TASK 4. SURFACE SAMPLING

The contractor shall conduct experiments that will determine the sampling method of B. anthracis surrogate spores from the provided subway surfaces. Such sampling methods may depend on the size (up to 14" by 14") of the available materials/coupons. The contractor shall determine the recovered number of spores following aerosol deposition of B. anthracis surrogate spores using sponge stick wipe and gauze wipe sampling as per established miscellaneous operating procedures (MOPs). Stainless steel coupons of equal size shall be sampled with both methods as reference coupons. Results from this test will determine the appropriate sampling method of the coupons under Task 6.

The contractor shall consider direct extraction of ballast rocks into a buffered solution for enumeration of spores and shall conduct experiments to demonstrate the extraction efficacy as function of number of rocks extracted in the top 3" layer.

TASK 5. INOCULATION

The contractor shall use a previously designed method for dry deposition of bioaerosols onto 14"×14" coupons (effective deposition area 12"×12") and/or modifications for smaller (down to 2" diameter) surface sizes. To eliminate the need of individual delivery systems, the contractor shall demonstrate that expected levels of spores can be delivered to smaller surface areas (equal or less than 1.5" x 1.5") without significant

settling time following inoculation, i.e. rely on impaction. The contractor shall evaluate whether reproducible aerosol deposition occurs such that dosing of multiple material coupons in immediate succession is possible using a single deposition procedure. Such assessment shall occur in triplicate (using stainless steel as the surface material) for each settling time. The contractor shall expect to consider up to four settling times. Wipe sampling from the individual surfaces shall be used to quantify the number of spores deposited.

TASK 6. DECONTAMINATION TESTS

The contractor shall expect to conduct sprayed pH amended bleach decontamination experiments using up to three subway building materials (concrete, ceramic tile, and painted carbon steel) and ballast consisting of crushed rock. For the building materials group, grimed coupons and grimed, than cleaned, coupons shall be included in the test matrix while only grimed ballast shall be considered.

For each test point, three replicates shall be decontaminated while three other coupons shall be used for positive controls. Each test point should include one laboratory blank (no inoculation, no decontamination) and one procedural blank (decontaminated with no inoculation). Coupons shall be positioned in both horizontal and vertical positions unless there is a single prevailing position for such material.

Each test shall include enumeration of residual viable spores from coupons surfaces and viable spores in effluent. The contractor shall determine the efficacy (log reduction) of the overall decontamination procedure per material and grime conditions. The contractor shall provide a qualitative assessment of the impacts that pAB has on the coupon materials. Digital photographs shall be made to support these observations.

An adaptive testing approach shall be used in which testing results will be used to modify subsequent decontamination conditions that would lead to improved performance, if applicable.

The contractor shall expect to conduct these tests at a high (greater than $1x10^7$ CFU per coupon).

All experiments shall be conducted using a medium, spray booth, size chamber. Initial parameters such as contamination concentrations, contact times will be established in consultation with the EPA WAM during the writing of the QAPP. The contractor shall expect to apply pAB twice on the ballast material.

TASK 7. TEST REPORT

The contractor shall generate a draft version of a full evaluation technical report (Draft I) detailing a summary of findings, test conditions, methods, quality assurance, test results, and lessons learned from the testing under Tasks 2-6. This report shall include

all procedural steps and any digital photos necessary to illustrate the findings. This Draft I version will be reviewed by the EPA WAM and EPA product team.

A second version (Draft II) of the report that incorporates the requested changes, corrections, and clarifications shall be submitted by the contractor following receipt of the combined comments from the EPA WAM and EPA product team. This draft report (Draft II) will be submitted by the EPA WAM for EPA peer reviews and Quality Assurance (QA) review.

A final report incorporating requested changes, correction, and clarification resulting from the EPA review process shall be submitted by the contractor. A separate document detailing the response to EPA QA comments shall also be submitted to the EPA WAM by the contractor with the final version of the report.

The report shall conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPN 800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

5. QUALITY ASSURANCE

A QAPP was under development and may have been approved by EPA during the previous option period (BASE). A QAPP must be approved prior to the start of any environmental data collection. Additional information related to the QA requirements can be found at http://www.epa.gov/quality.

6. DELIVERABLES

1. The contractor shall finalize the QAPP as per Task 1
2. The contractor shall transmit all data from Tasks 2-6 prior to the end of the option period. Raw and processed data shall be provided in MS Excel spreadsheets. Contractor shall transmit this data as soon as it has been internally reviewed for quality assurance.
3. The contractor shall create two draft reports and a final full evaluation report as per Task 7 description.
4. On a monthly basis for the duration of the project, the contractor shall submit, in electronic format, progress reports summarizing technical progress (including estimated percent of project completed), problems encountered, cumulative financial expenditures and cost and schedule variance.

7. SCHEDULE of DELIVERABLES

Deliverable	*Schedule*
QAPP Draft– Task 1	15 business days after award
QAPP Final	2 weeks after receipt EPA QA comments
Data summary spreadsheets for Tasks 2-6	July 31, 2016
Draft Test Report – Task 7	October 1, 2016
Final Report	December 31, 2016

8. KEY REFERENCES

[1] EPA report EPA/600/R-12/591: ***Assessment of Liquid and Physical Decontamination Methods for Environmental Surfaces Contaminated with Bacterial Spores: Evaluation of Spray Method Parameters and Impact of Surface Grime***

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-073

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017
Base Option Period Number 1

Title of Work Assignment/SF Site Name: 1-073 Wet Vacuum Samp....

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:
NOTE: WP amd 0 is in Supporting Documents b/c the contractor said it was not listed in FC so they were unable to load it up to FC for routing and approvals.

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Lukas Oudejans
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-2973
FAX Number:

Project Officer Name: Robin S. Harris
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0955
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-074

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Lukas Oudejans
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-2973
FAX Number:

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

To the Statement of Work
NHSRC QA Requirements/Definitions List

EPA=s Quality System Website: http://www.epa.gov/quality

EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html
EPA's Quality System Website: http://www.epa.gov/quality/qs-docs/r5-final.pdf

In accordance with EPA CIO 2105.0 (Order), EPA 2105-P-01-0 (Manual), and conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation described herein. All Quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approve the quality documentation. The Quality Assurance Project Plan (QAPP) shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government.

NHSRC's Quality System Specifications for Extramural Actions –

These requirements typically pertain to single project efforts. The five specifications are:

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

NHSRC QA Requirements/Definitions List

Category Level Designations (determines the level of QA required):

- ☐ **Category 1 Project** - applicable to studies performed to generate data used for enforcement activities, litigation, or research project involving human subjects. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

- ☐ **Category II Project** - applicable to studies performed to generate data used in support of the development of environmental regulations or standards. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

- ☐ **Category III Project** - applicable to projects involving applied research or technology evaluations. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP: QAPP** requirements for the specific project type (see below).

- ☐ **Category IV Project** - applicable to projects involving basic research or preliminary data gathering activities. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP. QAPP** requirements for the specific project type (see below).

Project Types:

These outlines of NHSRC's QAPP Requirements for various project types, from Appendix B of the NHSRC QMP (except where otherwise noted), are condensed from typically applicable sections of R-5 (EPA Requirements for QA Project Plans) and are intended to serve as a starting point when preparing a QAPP. These lists and their format may not fit every research scenario and QAPP's must conform to applicable sections of R-5 in a way that fully describes the research plan and appropriate QA and QC measures to ensure that the data are of adequate quality and quantity to fit their intended purpose.

- ☐ **Applied Research Project** - pertains to a study performed to generate data to demonstrate the performance of accepted processes or technologies under defined conditions. These studies are often pilot- or field-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Applied Research Projects" from Appendix B of the NHSRC QMP.

- ☐ **Basic Research Project** - pertains to a study performed to generate data used to evaluate unproven theories, processes, or technologies. These studies are often bench-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Basic Research Projects" from Appendix B of the NHSRC QMP.

- ☐ **Design, Construction, and/or Operation of Environmental Technology Project** - pertains to environmental technology designed, constructed and/or operated by and/or for EPA. The QAPP shall address requirements in the EPA Quality System document "Guidance on Quality Assurance for Environmental Technology Design, Construction, and Operation" G-11, at http://www.epa.gov/quality/QS-docs/g11-final-05.pdf. For additional information, you may refer to Part C of "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology," ANSI/ASQC E4-1994, American Society for Quality Control, Milwaukee, WI, January 1995.

- ☐ **Geospatial Data Quality Assurance Project** - pertains to data collection; data processing and analysis; and data validation of geospatial applications. The QAPP shall address requirements in the EPA Quality System document "Guidance for Geospatial Data Quality Assurance Project Plans" G-5S at http://www.epa.gov/quality/QS-docs/g5g-final-05.pdf.

- ☐ **Method Development Project** - pertains to situations where there is no existing standard method, or a standard method needs to be significantly modified for a specific application. The QAPP shall address all requirements listed in "QAPP Requirements for Method Development Projects" from Appendix B of the NHSRC QMP.

- ☐ **Model Development Project** - includes all types of mathematical models including static, dynamic, deterministic, stochastic, mechanistic, empirical, etc. The QAPP shall address requirements in the EPA Quality System document "Guidance for Quality Assurance Project Plans for Modeling" G-5M at http://www.epa.gov/quality/QS-docs/g5m-final.pdf.

- ☐ **Sampling and Analysis Project** - pertains to the collection and analysis of samples with no objectives other than to provide characterization or monitoring information. The QAPP shall address all requirements listed in "QAPP Requirements for Sampling and Analysis Projects" from Appendix B of the NHSRC QMP.

- **Secondary Data Project** - pertains to environmental data collected from other sources, by or for EPA, that are used for purposes other than those originally intended. Sources may include: literature, industry surveys, compilations from computerized databases and information systems, and computerized or mathematical models of environmental processes. The QAPP shall address all requirements listed in "QAPP Requirements for Secondary Data Projects" from Appendix B of the NHSRC QMP.

- **Software Development and Data Management Project** - pertains to software development, software/hardware systems development, database design and maintenance, data validation and verification systems. The QAPP shall address all requirements listed in "QAPP Requirements for Software Development Projects" from Appendix B of the NHSRC QMP.

Definitions:

Environmental Data - These are any measurement or information that describe environmental processes, location, or conditions; ecological or health effects directly from measurements, produced from software and models, and compiled from other sources such as data bases or the literature. For EPA, environmental data include information collected directly from measurements, produced from software and models, and compiled from other sources such as data bases or literature.

Incremental Funding - Incremental funding is partial funding, no new work.

Quality Assurance (QA) - Quality assurance is a system of management activities to ensure that a process, item, or service is of the type and quality needed by the customer. It deals with setting policy and running an administrative system of management controls that cover planning, implementation, and review of data collection activities and the use of data in decision making. Quality assurance is just one part of a quality system.

Quality Assurance Project Plan (QAPP) - A QAPP is a document that describes the necessary quality assurance, quality control, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. A QAPP documents project-specific information.

Quality Control (QC) - Quality control is a technical function that includes all the scientific precautions, such as calibrations and duplications, which are needed to acquire data of known and adequate quality.

Quality Management Plan (QMP) - A QMP is a document that describes an organization's/program's quality system in terms of the organizational structure, policy and procedures, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, documenting, and assessing all activities conducted. A QMP documents the overall organization/program, and is primarily applicable to multi-year, multi-project efforts. An organization's/program's QMP shall address all elements listed in the "Requirements for Quality Management Plans" in Appendix B of the NHSRC QMP.

Quality System - A quality system is the means by which an organization manages its quality aspects in a systematic, organized manner and provides a framework for planning, implementing, and assessing work performed by an organization and for carrying out required quality assurance and quality control activities.

R-2. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001
http://www.epa.gov/quality/QS-docs/r2-final.pdf.

R-5. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001
http://www.epa.gov/quality/QS-docs/r5-final.pdf.

Substantive Change - Substantive change is any change in an activity that may alter the quality of data being used, generated, or gathered.

Technical Lead Person (TLP) - This person is technically responsible for the project. For extramural contract work, the TLP is typically the contracting officer's representative (COR). For intramural work, the TLP is typically the Principal Investigator.

Abbreviations:

COR	Contracting Officer's Representative	IAG	Interagency Agreement
NHSRC	National Homeland Security Research Center	QA	Quality Assurance
NRMRL	National Risk Management Research Laboratory	QAM	Quality Assurance Manager
QA ID	Quality Assurance Identification	QMP	Quality Management Plan
QAPP	Quality Assurance Project Plan	SOW	Statement of Work
QS	Quality System	CRADA	Cooperative Research & Development Agreement
TLP	Technical Lead Person		

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-077

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Shannon Serre	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-3817
			FAX Number:
Project Officer Name Robin Baily	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-7906
			FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code:
			Phone Number:
			FAX Number:
Contracting Official Name Mark Cranley	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-487-2351
			FAX Number: 513-487-2109

PERFORMANCE WORK STATMENT

THE IMPACT OF OZONE ON MATERIALS AND EQUIPMENT

WA 1-77
CONTRACT: EP-C-16-008

WACOR: SHANNON SERRE
ALTERNATE WACOR: JOE WOOD

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HOMELAND SECURITY RESEARCH CENTER
DECONTAMINATION AND CONSEQUENCE MANAGEMENT DIVISION

TABLE OF CONTENTS

I. PERIOD OF PERFORMANCE 2
II. SUMMARY OF OBJECTIVES 2
III. RELEVANCE 2
VI. SCOPE 2
VII. TECHNICAL APPROACH 2
VIII. AFFORDABILITY 3
IX. TECHNICAL RISK 3
X. FACILITIES AND MATERIALS 3
XI. TASKS 3
Task 1 – Preparation of Work Assignment Work Plan 4
Task 2 – Determination of Test Equipment, Materials and Test Matrix 4
Task 3 – Conducting the Compatibility Testing 6
Task 4 – Reporting 6
XII. DELIVERABLE SCHEDULE 7
XIII. REPORTING REQUIREMENTS 7

TITLE
The Impact of Ozone on Materials and Equipment

I. PERIOD OF PERFORMANCE
The period of performance detailed in the Performance Work Statement (PWS) shall be from time of award through March 31, 2017.

II. SUMMARY OF OBJECTIVES
This work shall determine the impact of fumigation with ozone at sporicidal conditions on building materials and electronic equipment.

III. RELEVANCE
Fumigation with ozone for the decontamination of certain materials and equipment contaminated with anthrax spores has been suggested as an alternative to more harsh fumigants such as chlorine dioxide or hydrogen peroxide. Information on the compatibility of materials and equipment with ozone fumigation conditions effective for anthrax spores has not been determined in a systematic, reproducible way. Future guidance on selection and operation of decontamination technologies is dependent upon such information.

V. BACKGROUND
Under Homeland Security Presidential Directive (HSPD) 10, the U.S. Department of Homeland Security (DHS) is tasked to coordinate with other appropriate Federal departments and agencies, to develop comprehensive plans which, "provide for seamless, coordinated Federal, state, local, and international responses to a biological attack." As part of these plans, the U.S. Environmental Protection Agency (EPA), in a coordinated effort with DHS, is responsible for "developing strategies, guidelines, and plans for decontamination of persons, equipment, and facilities" to mitigate the risks of contamination following a biological weapons attack.

EPA's National Homeland Security Research Center (NHSRC) provides expertise and products that can be widely used to prevent, prepare for, and recover from public health and environmental emergencies arising from terrorist threats and incidents. NHSRC's Decontamination and Consequence Management Division (DCMD)'s decontamination research program's goal is to provides expertise and guidance on the selection and implementation of decontamination methods and provide the scientific basis for a significant reduction in the time and cost of decontamination events.

Past field experience and recent laboratory investigation have shown the effectiveness of several decontamination technologies for use against anthrax spores and other biological agents. The effectiveness of the technologies varies significantly as a function of operating conditions and challenge conditions (e.g., materials intended to be decontaminated). The use of chlorine dioxide (ClO_2) gas, fumigant hydrogen peroxide (H_2O_2), and methyl bromide has been shown to be effective in the field and laboratory when used in the appropriate circumstances. In addition to efficacy, the development of the remediation strategy also includes consideration of the ability to achieve effective conditions (e.g., fumigant concentration) within the application scenario and the impact of the decontamination process on materials and equipment.

VI. SCOPE
The purpose of this study is to determine the impact of ozone fumigation on relevant materials and equipment at decontamination conditions required for sporicidal kill in public facilities. This PWS covers the implementation of the treatment test matrix, the protocol for initial diagnostics, the comprehensive analysis of the treated equipment, and the reporting of the findings.

VII. TECHNICAL APPROACH
All test equipment and materials to be included in the test sets should have been procured under WA 0-77. The test equipment and materials are considered expendable items in this project. The contractor shall conduct pre-screening and documentation of all test equipment and materials prior to exposure to the fumigation conditions in accordance with the approved Quality Assurance Project Plan (QAPP). The contractor shall set-up the experimental system necessary to complete the fumigation testing. The system

shall allow for temperature, RH and ozone concentration controlled exposures for up to 48 hrs. The equipment shall be exposed to ozone by the contractor according to the finalized test matrix. The contractor shall then re-run the diagnostic protocol on fumigated computers and assess the impact on the other equipment and materials per the protocols. The contractor shall provide all data to the EPA WAM within one week following the fumigation test and within one week after completing diagnostic analysis on each computer system. All material and equipment shall be evaluated per the appropriate protocol (as documented in the approved QAPP) monthly for a period of 1 year following the fumigation date.

VIII. AFFORDABILITY

This effort is labor intensive, which is where the bulk of the funding is required. The ozone generator will be provided by the EPA and is not included as a cost to this WA.

IX. TECHNICAL RISK

The technical risk involved in this project is minimal. The ultimate goal in Task 3 is to determine the effect of ozone fumigation on electronic equipment. The null and alternative hypotheses are expected to be easily determined and verified.

X. FACILITIES AND MATERIALS

All experimental efforts shall be performed by the contractor at the U.S. EPA's Decontamination Technologies Research Laboratory (DTRL) located on the U.S. EPA campus in Research Triangle Park, NC. The ozone generator will be provided by the EPA and is not included as a cost to this WA.

XI. TASKS

The work to complete the tasks listed below shall be conducted in the NHSRC/DCMD's Decontamination Technologies Research Laboratories (DTRL) located on EPA's Research Triangle Park, NC campus. The deliverable dates and availability of vendor-supplied equipment shall be used by the contractor work assignment leader (WAL), in consultation with the EPA WAM, to determine the testing schedules.

The assessment of the impacts on three categories of items separated according to the analysis requirements shall be completed. The first category of materials (Category 2; there is no Category 1 for this SOW, but the numbering is maintained from previous efforts for consistency) includes materials that will be of typically low surface area within a building, but their functionality may be impacted by the fumigant or fumigation process. Analysis of the items in this category include visual inspection, surface analysis on selected samples (e.g., SEM), and standard methods for such materials as used within buildings (e.g., conductivity testing). The third category of materials (Category 3) includes small, personal electronic equipment and electrical circuits. The analysis shall be limited to functionality testing and visual inspection. The fourth category of materials (Category 4) includes computers and monitors. The primary focus for Category 4 materials is on the impact of the fumigant on the functionality of the equipment (material compatibility).

The contractor shall prepare a QAPP in accordance with Quality Assurance (QA) Category B, Attachment 1 to the Performance Work Statement (PWS) provides information regarding NHSRC QA Requirements/Definitions List. NOTE: The QAPP was generated in the previous work assignment.

QAPPs being developed for Category A (formerly Category 1 or 2) projects must be developed in accordance with the document titled "EPA Requirements for Quality Assurance Project Plans." EPA QA/R-5 can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf. At the discretion of the COR, a Category B (formerly category 3) QAPP can be developed based on the R5 guidance or a project-specific QA requirements. *The appropriate project-specific QA requirement information must be provided by the COR as Attachment 2 (optional).*

The QAPP must be approved prior to the start of any literature searches (existing data), data collection, gathering, synthesizing, or data generation (laboratory) work. Additional information related to QA requirements can be found at www.epa.gov/quality.

The following tasks are defined as part of this work assignment:

Task 1 – Preparation of Work Assignment Work Plan
A detailed Work Plan is due 20 calendar days after receipt of the approved Work Assignment. Content shall be in accordance with terms and conditions of the contract.

Task 2 – Determination of Test Equipment, Materials and Test Matrix
NHSRC is interested in the effects of decontamination processes for biological agents on electronic equipment. The fumigant of interest for this effort is ozone. The test materials and equipment for this effort shall include those items listed in Table 1 for Category 2 materials and Table 2 for Category 3 materials. Category 4 Equipment shall include desktop computers and monitors consistent with those used in previous material compatibility projects, these items are a Dell OptiPlex 780 Desktop Computer (or equivalent), a Dell 15 inch Flat Panel Monitor, a USB keyboard and mouse, and a computer and monitor power cords and connecting analog video cable (SVGA). All materials and equipment required for this testing were procured by the contractor under WA 0-77 as expendable test materials. Additional materials and equipment may be added to this list by the EPA WAM provided that it is within the available level of effort for the project or additional funding is provided via amendment of this work assignment. Additionally, a standard set of coupons to be fumigated with the computers shall be provided to the contractor by the EPA WAM. All materials and equipment shall be fumigated in triplicate at each test condition.

Table 1: Category 2 Materials

Material	Description	Supplier/ Manufacturer	Part Number	Coupon/ Sample Size
Type 3003 Aluminum	Textured 0.0625 inch thick sheet	McMaster Carr	88685K12	2" x 2", 3 pieces
Alloy 101 Copper	0.064" thick polished electrical grade, 99.99% pure	McMaster Carr	3350K19	2" x 2", 3 pieces
Low Carbon Steel	Un-milled 0.0625" thick	McMaster Carr	6615K29	1 ½" x 2" , 3 pieces
Type 316 Stainless Steel	0.0625" thick 2B finish	McMaster Carr	9090K11	2" x 2" , 3 pieces
Type 304 Stainless Steel	0.0625" thick #3 finish	McMaster Carr	9085K11	2" x 2" , 3 pieces
Type 410 Stainless Steel	0.0625 " thick	McMaster Carr	9524K62	2" x 2" , 3 pieces
Type 430 Stainless Steel	0.012" thick unpolished	McMaster Carr	8457K43	1" x 2" , 3 pieces
Type 309 Stainless Steel	0.0625" thick	McMaster Carr	9205K151	1 ½" x 2" , 3 pieces
DSL Line Conditioner	Phone and DSL connectors embedded within	McMaster Carr	1522T23	1 piece
Incandescent Light	With electrical switch	McMaster Carr	1627K48	1 piece
Steel Outlet/Switch Box	2" x 3 " x 1 ½ "	McMaster Carr	71695K81	1 piece
Silicone Caulk	Applied to switch box to test sealing capacity	McMaster Carr	7582T15	1" x 1"
Type 3003 Aluminum	Textured 0.0625 inch thick sheet	McMaster Carr	88685K12	2" x 2", 3 pieces

Material	Description	Supplier/ Manufacturer	Part Number	Coupon/ Sample Size
Yellow SJTO 300 VAC Service cord	16/3 AWG, .33" OD	McMaster Carr	8169K39	3 pieces
Smoke Detector	Battery-powered Ionization sensor with battery	First Alert	SA304	1 piece
Laser printed paper	Stack of 15 pages (first 15 pages of this QAPP)	RTO-E340-PS HP Color LaserJet	NA	8 ½" x 11"
Ink jet colored paper	Stack of 15 pages (test page used in previous work)	HP DeskJet 932C	NA	8 ½" x 11"
Color Photograph	4" x 6" Kodak processing	Walgreens	NA	4" x 6", 3 pieces
Static Intercept bags	20" x 24" x 0.003" bags	Dasal Technical products	NA	1 piece
ABS plastic	0.125" thick	McMaster Carr	8586K101	1½" x 2", 3 pieces
High density polyethylene plastic film	4 mil HDPE stretched across PVC tube	McMaster Carr	8552K81	2" x 4", 3 pieces
Low density polyethylene plastic film	4 mil LDPE stretched across PVC tube	McMaster Carr	8553K814	2" x 4", 3 pieces
Duct tape	2" wide Premium Duty, Fed. Spec. PPP-T-60E, Type IV, Class I. Used to seal plastic films onto PVC tube	McMaster Carr	7612A7	12" long circumference, 6 pieces
PVC plastic	2" x 4" rectangular tube, 0.098" wall	McMaster Carr	85095K95	1" length, 3 pieces

Table 2: Category 3 Materials and Equipment

Equipment	Description	Manufacturer	Model Number	Sample Size
Personal Digital Assistant (PDA)	Handheld	Palm	Z22	1 piece
Cell Phone	Pay as you go Super thin flip super phonic ring tones full color screen	Virgin (Kyocera)	Marbl	1 piece
Fax/Phone/ Copier Machine	Plain-paper fax and copier with 10-page auto document feeder and up to 50-sheet paper capacity. 512KB memory stores up to 25 pages for out-of-paper fax reception	Brother	Fax 575	1 piece
Data CD	Software CD	Snap!	01-0170-026-000	1 piece
Data DVD	Standard 21331 DVD Video	Warner Brothers	Harry Potter And the Sorcerer's Stone DVD	1 piece

The contractor shall provide technical support to the EPA WAM in the final decision on the material/equipment to be included based upon an understanding of the objectives of the study and

the physical properties/behavior of the fumigant. It is expected that ozone concentrations of up to 12,000 ppmv shall be used at a temperature of 75 °F and an RH of 85%.

The test matrix is shown in Table 3. In Test 2, computer system test set shall be fumigated individually. Thus, three fumigation cycles (or runs) will be required to complete Test 2 (fumigate all 3 computer system test sets).

Table 3A: Test Matrix for Category 2 and 3 Materials/Equipment

Test Condition	Equipment Power State During Fumigation	Treatment Conditions
1	On	Ozone concentration: RH, T, and other conditions to be determined
2	On	No ozone: same time, humidity and temperature in Test 1

Table 3B: Test Matrix for Category 4 Materials/Equipment

Test Condition	Equipment Power State During Fumigation	Treatment Conditions
1	On	Ozone: RH, T, and other conditions to be determined
2	On	Ozone: RH, T, and other conditions to be determined
3	Off	Ozone: RH, T, and other conditions to be determined
4	Off	No Ozone: same time, humidity and temperature in Tests 1-3

Task 3 – Conducting the Compatibility Testing

The contractor shall conduct the testing described in the QAPP that is developed as part of Task 1. This shall include running diagnostic testing on all equipment, including running the PC Doctor protocol on all computer systems. The PC Doctor protocol shall be provided by the EPA WAM. Digital photographs and documentation of the appearance or relevant properties, consistent with those defined in the QAPP, shall be made prior to exposure of the equipment/materials to the test conditions. The contractor shall assemble the necessary fumigation equipment to conduct the treatments. The equipment/materials shall be treated in accordance with the finalized test matrix to be included in the QAPP. After exposure, the assessment of the impact of the fumigation on the equipment/materials shall be performed. The assessment shall include complete documentation and digital photographs of all items. For computer systems, the PC Doctor diagnostic protocol shall be run post-exposure to the fumigation conditions. All assessments, including PC Doctor, shall be made monthly for up to one year following the fumigation event.

The contractor shall develop the health and safety research protocol (HSRP) for this work and obtain approval from the contractor and U.S. EPA health and safety officers prior to commencement of any studies.

Task 4 – Reporting

All data collected per the QAPP shall be submitted to the EPA WAM within one week after the completion of the analysis. Submission shall be via posting on the NHSRC share drive and by hard copy to the WAM.

Bi-weekly meetings shall be scheduled between the contractor WAL and the EPA WAM to discuss relevant results.

The computers and equipment shall be monitored for one year from the date of fumigation. A draft report shall be written describing the testing and results from the testing. A draft report shall be delivered on 28 February 2017, assuming the one year date of exposure has been achieved.

XII. DELIVERABLE SCHEDULE

- On a monthly basis for the duration of the project, the contractor shall submit, in electronic format, progress reports summarizing technical progress (including estimated percent of project completed), problems encountered, quarterly and cumulative financial expenditures and cost and schedule variance.

Table 4: Deliverable Schedule

Deliverable	Date
Data Summaries	On-going
Draft Report	28 February 2017

XIII. REPORTING REQUIREMENTS

- The Contractor shall prepare Quality Control data reports of all facility-specific data. Each Quality Control report shall be in a format suitable for EPA/NHSRC publication and shall discuss how well various measurements described in the QA plan were met.
- The monthly invoice reports for this work assignment shall provide a detailed description of any equipment or expendables that have been purchased by the contractor for use on the projects discussed herein.
- In lieu of a final technical report, journal papers within each task may be submitted at the discretion of the EPA WAM. The papers shall be authored or co-authored by the EPA WAM, at the discretion of the WAM. To serve in lieu of the final report, the journal articles must contain all of the relevant information that would have appeared in the final report.
- All products developed under this SOW (e.g., the above mentioned technical report) must conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-077

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2016
Base Option Period Number 1

Title of Work Assignment/SF Site Name:

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:
The purpose of this amendment is to revise tasks of the PWS.

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Shannon Serre
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-3817
FAX Number:

Project Officer Name Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

PERFORMANCE WORK STATMENT

THE IMPACT OF FOGGING ON MATERIALS AND EQUIPMENT

WA 1-77
CONTRACT: EP-C-16-008

WACOR: SHANNON SERRE
ALTERNATE WACOR: JOE WOOD

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HOMELAND SECURITY RESEARCH CENTER
DECONTAMINATION AND CONSEQUENCE MANAGEMENT DIVISION

TABLE OF CONTENTS

I. PERIOD OF PERFORMANCE 2
II. SUMMARY OF OBJECTIVES 2
III. RELEVANCE 2
VI. SCOPE 2
VII. TECHNICAL APPROACH 2
VIII. AFFORDABILITY 3
IX. TECHNICAL RISK 3
X. FACILITIES AND MATERIALS 3
XI. TASKS 3
Task 1 – Preparation of Work Assignment Work Plan 4
Task 2 – Determination of Test Equipment, Materials and Test Matrix 4
Task 3 – Conducting the Compatibility Testing 6
Task 4 – Reporting 7
Task 5 – Revision of Material Compatibility with Gamma Radiation Report 7
XII. DELIVERABLE SCHEDULE 7
XIII. REPORTING REQUIREMENTS 7

TITLE
The Impact of Fogging on Materials and Equipment

I. PERIOD OF PERFORMANCE
The period of performance detailed in the Performance Work Statement (PWS) shall be from time of award through March 31, 2017.

II. SUMMARY OF OBJECTIVES
This work shall determine the impact of fogging with liquid sporicides on building materials and electronic equipment.

III. RELEVANCE
Fogging using liquid sporicides has been shown to be efficacious for decontamination of certain materials and equipment contaminated with anthrax spores. Information on the compatibility of materials and equipment with fogging conditions effective for anthracis spores has not been determined in a systematic, reproducible way. Future guidance on selection and operation of decontamination technologies is dependent upon such information.

V. BACKGROUND
Under Homeland Security Presidential Directive (HSPD) 10, the U.S. Department of Homeland Security (DHS) is tasked to coordinate with other appropriate Federal departments and agencies, to develop comprehensive plans which, "provide for seamless, coordinated Federal, state, local, and international responses to a biological attack." As part of these plans, the U.S. Environmental Protection Agency (EPA), in a coordinated effort with DHS, is responsible for "developing strategies, guidelines, and plans for decontamination of persons, equipment, and facilities" to mitigate the risks of contamination following a biological weapons attack.

EPA's National Homeland Security Research Center (NHSRC) provides expertise and products that can be widely used to prevent, prepare for, and recover from public health and environmental emergencies arising from terrorist threats and incidents. NHSRC's Decontamination and Consequence Management Division (DCMD)'s decontamination research program's goal is to provides expertise and guidance on the selection and implementation of decontamination methods and provide the scientific basis for a significant reduction in the time and cost of decontamination events.

Past field experience and recent laboratory investigation have shown the effectiveness of several decontamination technologies for use against anthrax spores and other biological agents. The effectiveness of the technologies varies significantly as a function of operating conditions and challenge conditions (e.g., materials intended to be decontaminated). The use of chlorine dioxide (ClO_2) gas, fumigant hydrogen peroxide (H_2O_2), and methyl bromide has been shown to be effective in the field and laboratory when used in the appropriate circumstances. In addition to efficacy, the development of the remediation strategy also includes consideration of the ability to achieve effective conditions (e.g., fumigant concentration) within the application scenario and the impact of the decontamination process on materials and equipment.

VI. SCOPE
The purpose of this study is to determine the impact of fogging liquid sporicides on relevant materials and equipment at decontamination conditions required for sporicidal kill in public facilities. This PWS covers the implementation of the treatment test matrix, the protocol for initial diagnostics, the comprehensive analysis of the treated equipment, and the reporting of the findings.

VII. TECHNICAL APPROACH
All test equipment and materials to be included in the test sets should have been procured under WA 0-77. The test equipment and materials are considered expendable items in this project. The contractor shall conduct pre-screening and documentation of all test equipment and materials prior to exposure to the fogging conditions in accordance with the approved Quality Assurance Project Plan (QAPP). The contractor shall set-up the experimental system necessary to complete the fogging testing. The equipment

shall be exposed to liquid sporicides via fogging by the contractor according to the finalized test matrix. The contractor shall then re-run the diagnostic protocol on fumigated computers and assess the impact on the other equipment and materials per the protocols. The contractor shall provide all data to the EPA WAM within one week following the fogging test and within one week after completing diagnostic analysis on each computer system. All material and equipment shall be evaluated per the appropriate protocol (as documented in the approved QAPP) monthly for a period of 1 year following the fogging date.

VIII. AFFORDABILITY

This effort is labor intensive, which is where the bulk of the funding is required. Normal expendable laboratory items are required for this project.

IX. TECHNICAL RISK

The technical risk involved in this project is minimal. The ultimate goal in Task 3 is to determine the effect fogging of liquid sporicides on electronic equipment. The null and alternative hypotheses are expected to be easily determined and verified.

X. FACILITIES AND MATERIALS

All experimental efforts shall be performed by the contractor at the U.S. EPA's Decontamination Technologies Research Laboratory (DTRL) located on the U.S. EPA campus in Research Triangle Park, NC.

XI. TASKS

The work to complete the tasks listed below shall be conducted in the NHSRC/DCMD's Decontamination Technologies Research Laboratories (DTRL) located on EPA's Research Triangle Park, NC campus. The deliverable dates and availability of vendor-supplied equipment shall be used by the contractor work assignment leader (WAL), in consultation with the EPA WAM, to determine the testing schedules.

The assessment of the impacts on three categories of items separated according to the analysis requirements shall be completed. The first category of materials (Category 2; there is no Category 1 for this SOW, but the numbering is maintained from previous efforts for consistency) includes materials that will be of typically low surface area within a building, but their functionality may be impacted by the decontamination process. Analysis of the items in this category include visual inspection, surface analysis on selected samples (e.g., SEM), and standard methods for such materials as used within buildings (e.g., conductivity testing). The third category of materials (Category 3) includes small, personal electronic equipment and electrical circuits. The analysis shall be limited to functionality testing and visual inspection. The fourth category of materials (Category 4) includes computers and monitors. The primary focus for Category 4 materials is on the impact of fogging on the functionality of the equipment (material compatibility).

The contractor shall prepare a QAPP in accordance with Quality Assurance (QA) Category B, Attachment 1 to the Performance Work Statement (PWS) provides information regarding NHSRC QA Requirements/Definitions List. NOTE: The existing QAPP will need to be modified.

QAPPs being developed for Category A (formerly Category 1 or 2) projects must be developed in accordance with the document titled "EPA Requirements for Quality Assurance Project Plans." EPA QA/R-5 can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf. At the discretion of the COR, a Category B (formerly category 3) QAPP can be developed based on the R5 guidance or a project-specific QA requirements. *The appropriate project-specific QA requirement information must be provided by the COR as Attachment 2 (optional).*

The QAPP must be approved prior to the start of any literature searches (existing data), data collection, gathering, synthesizing, or data generation (laboratory) work. Additional information related to QA requirements can be found at www.epa.gov/quality.

The following tasks are defined as part of this work assignment:

Task 1 – Preparation of Work Assignment Work Plan
A detailed Work Plan is due 10 calendar days after receipt of the approved Work Assignment. Content shall be in accordance with terms and conditions of the contract.

Task 2 – Determination of Test Equipment, Materials and Test Matrix
NHSRC is interested in the effects of decontamination processes for biological agents on electronic equipment. Liquid sporicides will be fogged onto the materials listed. The test materials and equipment for this effort shall include those items listed in Table 1 for Category 2 materials and Table 2 for Category 3 materials. Category 4 Equipment shall include desktop computers and monitors consistent with those used in previous material compatibility projects, these items are a Dell OptiPlex 780 Desktop Computer (or equivalent), a Dell 15 inch Flat Panel Monitor, a USB keyboard and mouse, and a computer and monitor power cords and connecting analog video cable (SVGA). All materials and equipment required for this testing were procured by the contractor under WA 0-77 as expendable test materials. Additional materials and equipment may be added to this list by the EPA WAM provided that it is within the available level of effort for the project or additional funding is provided via amendment of this work assignment. Additionally, a standard set of coupons to be fogged with the computers shall be provided to the contractor by the EPA WAM. All materials and equipment shall be treated with the fogger in triplicate at each test condition.

Table 1: Category 2 Materials

Material	Description	Supplier/ Manufacturer	Part Number	Coupon/ Sample Size
Type 3003 Aluminum	Textured 0.0625 inch thick sheet	McMaster Carr	88685K12	2" x 2", 3 pieces
Alloy 101 Copper	0.064" thick polished electrical grade, 99.99% pure	McMaster Carr	3350K19	2" x 2", 3 pieces
Low Carbon Steel	Un-milled 0.0625" thick	McMaster Carr	6615K29	1 ½" x 2" , 3 pieces
Type 316 Stainless Steel	0.0625" thick 2B finish	McMaster Carr	9090K11	2" x 2" , 3 pieces
Type 304 Stainless Steel	0.0625" thick #3 finish	McMaster Carr	9085K11	2" x 2" , 3 pieces
Type 410 Stainless Steel	0.0625 " thick	McMaster Carr	9524K62	2" x 2" , 3 pieces
Type 430 Stainless Steel	0.012" thick unpolished	McMaster Carr	8457K43	1" x 2" , 3 pieces
Type 309 Stainless Steel	0.0625" thick	McMaster Carr	9205K151	1 ½" x 2" , 3 pieces
DSL Line Conditioner	Phone and DSL connectors embedded within	McMaster Carr	1522T23	1 piece
Incandescent Light	With electrical switch	McMaster Carr	1627K48	1 piece
Steel Outlet/Switch Box	2" x 3 " x 1 ½ "	McMaster Carr	71695K81	1 piece
Silicone Caulk	Applied to switch box to test sealing capacity	McMaster Carr	7582T15	1" x 1"
Type 3003 Aluminum	Textured 0.0625 inch thick sheet	McMaster Carr	88685K12	2" x 2", 3 pieces

Material	Description	Supplier/ Manufacturer	Part Number	Coupon/ Sample Size
Yellow SJTO 300 VAC Service cord	16/3 AWG, .33" OD	McMaster Carr	8169K39	3 pieces
Smoke Detector	Battery-powered Ionization sensor with battery	First Alert	SA304	1 piece
Laser printed paper	Stack of 15 pages (first 15 pages of this QAPP)	RTO-E340-PS HP Color LaserJet	NA	8 ½" x 11"
Ink jet colored paper	Stack of 15 pages (test page used in previous work)	HP DeskJet 932C	NA	8 ½" x 11"
Color Photograph	4" x 6" Kodak processing	Walgreens	NA	4" x 6", 3 pieces
Static Intercept bags	20" x 24" x 0.003" bags	Dasal Technical products	NA	1 piece
ABS plastic	0.125" thick	McMaster Carr	8586K101	1½" x 2", 3 pieces
High density polyethylene plastic film	4 mil HDPE stretched across PVC tube	McMaster Carr	8552K81	2" x 4", 3 pieces
Low density polyethylene plastic film	4 mil LDPE stretched across PVC tube	McMaster Carr	8553K814	2" x 4", 3 pieces
Duct tape	2" wide Premium Duty, Fed. Spec. PPP-T-60E, Type IV, Class I. Used to seal plastic films onto PVC tube	McMaster Carr	7612A7	12" long circumference, 6 pieces
PVC plastic	2" x 4" rectangular tube, 0.098" wall	McMaster Carr	85095K95	1" length, 3 pieces

Table 2: Category 3 Materials and Equipment

Equipment	Description	Manufacturer	Model Number	Sample Size
Personal Digital Assistant (PDA)	Handheld	Palm	Z22	1 piece
Cell Phone	Pay as you go Super thin flip super phonic ring tones full color screen	Virgin (Kyocera)	Marbl	1 piece
Fax/Phone/ Copier Machine	Plain-paper fax and copier with 10-page auto document feeder and up to 50-sheet paper capacity. 512KB memory stores up to 25 pages for out-of-paper fax reception	Brother	Fax 575	1 piece
Data CD	Software CD	Snap!	01-0170-026-000	1 piece
Data DVD	Standard 21331 DVD Video	Warner Brothers	Harry Potter And the Sorcerer's Stone DVD	1 piece

The contractor shall provide technical support to the EPA WAM in the final decision on the material/equipment to be included based upon an understanding of the objectives of the study and

the physical properties/behavior of the liquid sporicide being fogged. The fogging of sporicidal liquids (such as pH-amended bleach, chlorine dioxide, others) shall be considered.

The test matrix is shown in Table 3. In Test 2, computer system test set shall be fogged individually. Thus, three fogging cycles (or runs) will be required to complete Test 2 (fumigate all 3 computer system test sets).

Table 3A: Test Matrix for Category 2 and 3 Materials/Equipment

Test Condition	Equipment Power State During Fogging	Treatment Conditions
1	TBD	Liquid sporicide, temperature, RH, and time will be determined.
2	TBD	No sporicide: same time, humidity and temperature in Test 1

Table 3B: Test Matrix for Category 4 Materials/Equipment

Test Condition	Equipment Power State During Fogging	Treatment Conditions
1	TBD	Sporicide: RH, T, time and other conditions to be determined
2	TBD	Sporicide: RH, T, time and other conditions to be determined
3	TBD	Sporicide: RH, T, time and other conditions to be determined
4	TBD	No sporicide: same time, humidity and temperature in Tests 1-3

Task 3 – Conducting the Compatibility Testing

The contractor shall conduct the testing described in the QAPP that is developed as part of Task 1. This shall include running diagnostic testing on all equipment, including running the PC Doctor protocol on all computer systems. The PC Doctor protocol shall be provided by the EPA WAM. Digital photographs and documentation of the appearance or relevant properties, consistent with those defined in the QAPP, shall be made prior to exposure of the equipment/materials to the test conditions. The contractor shall assemble the necessary fogging equipment to conduct the treatments. The equipment/materials shall be treated in accordance with the finalized test matrix to be included in the QAPP. After exposure, the assessment of the impact of the fogging on the equipment/materials shall be performed. The assessment shall include complete documentation and digital photographs of all items. For computer systems, the PC Doctor diagnostic protocol shall be run post-exposure to the fogging conditions. All assessments, including PC Doctor, shall be made monthly for up to one year following the fogging exposure.

The contractor shall develop the health and safety research protocol (HSRP) for this work and obtain approval from the contractor and U.S. EPA health and safety officers prior to commencement of any studies.

Task 4 – Reporting
All data collected per the QAPP shall be submitted to the EPA WAM within one week after the completion of the analysis. Submission shall be via posting on the NHSRC share drive and by hard copy to the WAM.

Bi-weekly meetings shall be scheduled between the contractor WAL and the EPA WAM to discuss relevant results.

The computers and equipment shall be monitored for one year from the date of fogging. A draft report shall be written describing the testing and results from the testing.

Task 5 – Revision of Material Compatibility with Gamma Radiation Report
Contractor shall assist in the revision of the Material Compatibility with Gamma Radiation Report.

XII. DELIVERABLE SCHEDULE

- On a monthly basis for the duration of the project, the contractor shall submit, in electronic format, progress reports summarizing technical progress (including estimated percent of project completed), problems encountered, quarterly and cumulative financial expenditures and cost and schedule variance.

Table 4: Deliverable Schedule

Deliverable	Date
Data Summaries	On-going
QAPP Revision	30 days after award of WA

XIII. REPORTING REQUIREMENTS

- The Contractor shall prepare Quality Control data reports of all facility-specific data. Each Quality Control report shall be in a format suitable for EPA/NHSRC publication and shall discuss how well various measurements described in the QA plan were met.
- The monthly invoice reports for this work assignment shall provide a detailed description of any equipment or expendables that have been purchased by the contractor for use on the projects discussed herein.
- In lieu of a final technical report, journal papers within each task may be submitted at the discretion of the EPA WAM. The papers shall be authored or co-authored by the EPA WAM, at the discretion of the WAM. To serve in lieu of the final report, the journal articles must contain all of the relevant information that would have appeared in the final report.
- All products developed under this SOW (e.g., the above mentioned technical report) must conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-078

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017
Base Option Period Number 1

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance
From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Lukas Oudejans
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-2973
FAX Number:

Project Officer Name Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Water rinses and its impact on decontamination efficacies

WA #: 1-078 WACOR: Lukas Oudejans

Contract #: EP-C-15-008 Alternate WACOR: Matthew Magnuson

NHSRC Project Number: HS8.63.02-0106

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

This work will evaluate the impact of water rinses on the overall decontamination efficacy when water rinses are included in the decontaminating process of surfaces contaminated with organophosphate pesticides and/or surrogates chemical warfare agents.

BACKGROUND

EPA is designated a coordinating Agency, under the National Response Framework, to prepare for, respond to, and recover from a threat to public health, welfare, or the environment caused by actual or potential oil and hazardous materials incidents. Hazardous materials include chemical, biological, and radiological substances, whether accidentally or intentionally released.

The imminent threat of a chemical agent release in a building or transportation hub is driving US EPA's Homeland Security Research Program (HSRP) to develop a research program that systematically evaluates potential decontamination technologies for chemical agents.

Research efforts have focused on volumetric decontamination using various fumigants (chlorine dioxide, hydrogen peroxide, steam, etc.) and surface decontamination options using commercially available products that were expected to neutralize the chemical agent (e.g., bleach, hydrogen peroxide solution, EasyDecon DF-200, etc.). The surface decontamination efforts so far have been limited to the measurement of efficacy of the decontamination product itself after a fixed contact time. This Performance Work Statement (PWS) describes research that is needed to understand the impact of water rinses will have on the overall decontamination efficacy.

SCOPE

This study will measure the chemical amounts extracted from surfaces during the various steps of the decontamination procedure consisting of (1) a pre-rinse of the surface with water; (2) application of the decontaminant; and (3) a post-rinse of the surface with water to remove the residual decontaminant.

TECHNICAL APROACH/OBJECTIVES

Details in specific tasks are described below. The Contractor shall procure representative materials to create sufficient coupons of approximately 12" x 12" surface area to complete all tests. The targeted chemicals will be identified by the EPA WACOR during the WA kick-off meeting. Coupons will be wiped using existing procedures as documented in the EPA Selected Analytical Methods (SAM) document. Application of the chemical shall consist of discrete droplets of chemical or a spray type application to create a thin film of otherwise equal surface concentration as the discrete droplet application.

Task 1: Preparation of the Quality Assurance Project Plan (QAPP)

The Contractor shall prepare a QAPP in accordance with Quality Assurance (QA) Category B. Attachment 1 to the Performance Work Statement (PWS) or Statement of Work (SOW) provides information regarding NHSRC QA Requirements/Definitions List.

QAPPs prepared for a Category B (formerly known as a Category 3 or 4) project must be developed in accordance with the document titled "EPA Requirements for Quality Assurance Project Plans." EPA QA/R-5 can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf and must be approved by an EPA Quality Assurance Manager (QAM) prior to the start of any literature searches (existing data), data collection, gathering, synthesizing, or data generation (laboratory) work.

At the discretion of the Work Assignment Contract Officer Representative (WACOR), a Category B QAPP may be based on the R5 guidance (described above) or on a NHSRC project-specific QA requirements template provided as Attachment 2.

Additional information related to QA requirements can be found at www.epa.gov/quality.

Task 2: Method Development

The Contractor shall demonstrate prior to the decontamination testing a consistent and highly efficient sampling of surfaces through wiping of the surfaces using existing sampling approaches as described in NHSRC's SAM document. The contractor shall demonstrate that wipe samples are not degrading with time between collection and analysis.

Task 3: Determination of Decontamination efficacy

The contractor shall expect to conduct a series of tests to evaluate the impact of water rinses on the overall decontamination efficacy through the measurement of chemical amounts remaining on surfaces following a pre-rinse of the surface with water; following application of the decontaminant; and following a post-rinse of the surface with water. These tests shall be conducted with surfaces positioned horizontally and vertically and shall also include measurement of chemical agent in the liquid runoffs of each step. The contractor shall anticipate to conduct up to 12 tests consisting of three materials, two chemicals, and two orientations. Each test point shall consist of three replicate test coupons, three positive control coupons (contaminated but not decontaminated) and a procedural blank (not contaminated but decontaminated like a test coupon). Specific test conditions will be communicated to the contractor by the EPA WAM during the WA kickoff meeting.

Task 4: Reporting

The contractor shall prepare a test report (a draft for WAM review and approval; a revised draft for peer and QA review; and a final) which shall include the test conditions, methods, quality assurance, and results of the tests under Tasks 3 and 4 per the requirements of this PWS. The report shall conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

WA SPECIFIC EQUIPMENT

No specific equipment has been identified for acquisition by the contractor

QUALITY ASSURANCE

The QAPP must be approved prior to the start of any environmental data collection. See Task 1 for more information on its development. Additional information related to the QA requirements can be found at http://www.epa.gov/quality.

DELIVERABLES

The WACOR and contractor's project manager shall arrange project meetings to discuss Task-specific progress, issues, and action items.

The Contractor's monthly report to EPA shall summarize work activities (accomplished and planned) in this work assignment, including the status of applicable test, QA, and safety plans. The monthly report shall also detail labor costs and ODC charges.

SCHEDULE of DELIVERABLES

Task Number	*Deliverable*	*Schedule*
1	QAPP Draft– Task 1	20 business days after award
1	QAPP Final	2 weeks after receipt EPA QA comments
4	Draft Test Report	February 1, 2017
4	Final Report	March 31, 2017

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-080

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base X Option Period Number	1-080

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — **Accounting and Appropriations Data** — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Joe Wood	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-5029 FAX Number: 919-541-0496
Project Officer Name Robin Baily	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Mark Cranley	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

Performance Work Statement

Feasibility Study for Capture of Methyl Bromide
WA 1-080
ON-SITE RESEARCH LABORATORY SUPPORT CONTRACT EP-C-15-08
WACOR Joseph Wood
Alt WACOR Shannon Serre

I. PERIOD OF PERFORMANCE

The period of performance for this work assignment (WA 080) shall be from April 1, 2016 to March 31, 2017.

II. SUMMARY OF OBJECTIVES

This work will involve laboratory experiments relative to the capture of methyl bromide (MeBr) using activated carbon, and the regeneration of the activated carbon.

III. BACKGROUND

MeBr fumigation has been shown to be effective in decontaminating buildings contaminated with *Bacillus anthracis* (Ba) spores. Further, previous lab and field tests have shown that activated carbon (AC) is effective in capturing the MeBr following fumigation. In the event of a large urban Ba spore release, large quantities of MeBr would be needed. The purpose of this study is to evaluate the feasibility of options that could be used to capture the MeBr following decontamination and then process the activated carbon for reuse.

IV. TECHNICAL APPROACH

This WA is a continuation of a similar previous WA 0-080. A QAPP has already been developed.

V. AFFORDABILITY

This effort is labor intensive, which is where the bulk of the funding is required. Normal expendable laboratory items are also required for this project.

VI. FACILITIES AND MATERIALS

All tasks described in this SOW shall be performed in-house, at the EPA's Research Triangle Park (RTP) facilities at 109 T.W. Alexander Dr.

VII. TASKS

The Contractor shall perform the following tasks:

1. Finish set up of experimental apparatus (begun under WA 0-080) and conduct multiple experiments to assess the performance of activated carbon in capturing MeBr as a function of the multiple activated carbon regeneration cycles. These experiments shall be conducted according to QAPP developed under WA 0-080.

2. Provide general support for maintaining the lab equipment. This support shall include assembly, maintenance, troubleshooting, and configuration support for the any equipment used for testing. Support shall also include the purchase of any expendable materials, with prior approval from the WAM, for use in this project.

3. Report the results of all tests to the WAM as soon as possible via email and through the use of the DTRL share drive. The WAM shall be notified immediately of any problems encountered in the laboratory or with the results obtained. These data shall include any generated data files (i.e., logged data) properly annotated, reports of the experimental conditions, calibration checks, measured variables, and a listing of the samples awaiting further analysis.

4. Analyze the data per the requirements in the QAPP and in consultation with the WAM, report the results of these analyses as soon as possible via email and through the use of the DTRL share drive. The expected data analyses would be in the form of Excel spreadsheets or other appropriate software.

5. Meet with the WAM at least every week to provide a project status update. The update shall include a synopsis of activities taking place the past week, problems encountered, and work planned for the next week.

6. Update the health and safety research protocols, as needed, as required by the EPA Facility and APPCD safety personnel. Updates to these protocols shall be approved by the EPA WAM and safety personnel prior to the commencement of any testing. The contractor shall provide a copy of the health and safety plan to the WAM and the ORD-Safety Office for discussion.

7. Prepare monthly reports to EPA that summarize work activities (accomplished and planned) in this work assignment, including the status of applicable test, QA, and safety plans. The monthly report shall also detail labor costs and ODC charges. The ODC charges shall be documented in the report in a way that the items purchased, vendor, and cost are clearly indicated.

VIII. DELIVERABLE SCHEDULE

The following table outlines the expected schedule that the contractor shall meet for the period covered by this SOW. The schedule assumes a start date of April 1, 2013. Dates dependent upon completion of specific tasks shall be updated based on discussions between the contractor WAL and EPA WAM during the development of the test plans to cover the work specified herein.

Suggested Deliverable Schedule

Deliverable	**Completion Date**
Submit work assignment plan	4/15/16
Complete experimental set up under Task 1	5/1/16

Complete Task 1 experiments	3/15/17
Complete data analysis per Task 4	3/31/17
Complete other tasks	ongoing

IX. REPORTING REQUIREMENTS

- The Contractor shall prepare a brief memorandum to the WAM which discusses how well various measurements described in the QA plan were met.

- The monthly invoice reports for this work assignment shall provide a detailed description of any equipment or expendables that have been purchased by the contractor for use on the projects discussed herein.

- All data and analyses worksheets generated as discussed in Section VII. shall be provided in electronic format in Excel and/or other appropriate software, in consultation with the WAM.

X. QUALITY ASSURANCE

The Tasks outlined in this PWS shall be conducted according to the existing QAPP titled FEASIBILITY STUDY FOR REUSE OF ACTIVATED CARBON FOR CAPTURE OF METHYL BROMIDE, QA approval date 12/01/2015.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-081

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2015 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Joe Wood
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-5029
FAX Number: 919-541-0496

Project Officer Name Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Work Statement

Fogging of Sporicidal Liquids
WA 1-081
ON-SITE RESEARCH LABORATORY SUPPORT CONTRACT EP-C-15-08
WACOR Joseph Wood
Alt WACOR Worth Calfee

I. PERIOD OF PERFORMANCE

The period of performance for this work assignment (WA 081) shall be from April 1, 2016 to August 31, 2016.

II. SUMMARY OF OBJECTIVES

This work will assess the decontamination efficacy for the fogging of sporicidal liquids (such as pH-amended bleach, chlorine dioxide, others) in inactivating bacterial spores (surrogate for *Bacillus anthracis*) inoculated onto building and other types of materials.

III. BACKGROUND

The results of these tests will provide information on how effective different fogs of sporicidal liquids are in inactivating bacterial spores as a function of material, sporicidal liquid, and fogging operational parameters. This information will be useful in determining whether fogging may be an appropriate decontamination technique for certain types of materials or environments following an intentional release of *B. anthracis* spores. This WA is a continuation of the previous WA 081, although no work shall be duplicated.

The purpose of the study is to quantify the recovery of a *B. anthracis* spore surrogate from building and outdoor materials (coupons), with and without exposure to an aerosolized sporicidal liquid. Experimental variables may include, but are not limited to, the sporicidal liquid, coupon material, fog operational parameters such as the quantity fogged and contact time, and coupon location or orientation within the test chamber. The test matrix will be adjusted as testing proceeds to discover the minimum fog requirements needed for effective fog conditions, e.g., greater than six log reduction (LR) achieved on all coupons. The bacterium *B. atrophaeus* (aka Bg) will be the test surrogate organism. The materials that will be used for testing have not been selected at the writing of this Task Order, but will be selected in consultation with the WAM.

The fog tests shall be conducted in a chamber with a volume ~ 24 cubic meters, to allow for sufficient dispersal of the sporicidal aerosol. Sufficient replicates, blanks, and positive controls shall be used, consistent with previous EPA and other peer reviewed anthrax decontamination studies and quality assurance procedures.

IV. TECHNICAL APPROACH

For each test, the effort shall include the recovery of the spore surrogate from each material before (positive control) and after each test has been completed. For each test, five replicates for each test material and five replicates for each positive control shall be included in each experiment.

V. AFFORDABILITY

This effort is primarily labor intensive, which is where the bulk of the funding is required. Normal expendable laboratory items are also required for this project.

VI. FACILITIES AND MATERIALS

All tasks described in this SOW shall be performed in-house, at the EPA's Research Triangle Park (RTP) facilities at 109 T.W. Alexander Dr.

VII. TASKS

The Contractor shall perform the following tasks:

1. The contractor shall conduct testing according to the following requirements:

    A. All testing and related measurements, as outline below in this Task 1, shall be performed according to the QAPP developed under WA 81 in base period of this contract.

    B. Coupons and microbiological and related methods (e.g., spore preparation, sterilization and preparation of coupons, numbers of replicates and blanks, inoculation of spores onto coupons, recovery and quantitation of spores from coupons, characterization of efficacy, etc.) shall be consistent with the QAPP developed under WA 0-081. It is expected that 18 mm coupons shall be used for testing and inoculated using a metered dose inhaler approach.

    C. Test Matrix: The contractor shall conduct 8-10 fog chamber tests. Initial test conditions shall be selected in consultation with the WAM. That is, in consultation with the WAM, the test matrix will be adjusted as testing proceeds to discover the minimum fog requirements needed for effective fog conditions, e.g., greater than six LR achieved on all coupons. Adjustments in fog requirements may include parameters such as sporicidal liquid quantity to be fogged, fog duration, dwell time, type of fogger, and minimum or maximum RH levels. Other experimental variables may include, but are not limited to, the sporicidal liquid, coupon material, and coupon location or orientation within the test chamber. Sporicidal liquids to be assessed initially shall include pH-amended bleach, but may also include (but not limited to) other liquid sporicides such as dichlor, aqueous hydrogen peroxide solutions, and chlorine dioxide.

D. Following inoculation of spores onto coupons, test coupons shall be placed throughout the test chamber, oriented vertically and horizontally, and may be placed underneath or behind objects in the chamber to assess adequate dispersion of the fog. Positive control coupons shall be placed in a separate small chamber and left undisturbed until completion of each experiment. Following each experiment, test coupons, blanks, and positive control coupons shall be collected and then analyzed.

E. Measurement of fog environment: Measurement and logging of data for fog and chamber environmental and operational parameters such as temperature, RH, and concentration shall be conducted for each experiment according to the QAPP.

F. Documentation of visible damage to materials as a result of fogging: The contractor shall note any visible change or damage in appearance to coupon materials at 1 and 7 days after completion of each experiment. Visible changes (i.e., comparing positive controls to test coupons) to materials shall be documented with photographs.

2. Provide general support for maintaining the lab equipment. This support shall include assembly, maintenance, troubleshooting, and configuration support for the any equipment used for testing. Support shall also include the purchase of any expendable materials, with prior approval from the WAM, for use in this project.

3. Report the results of all tests to the WAM as soon as possible via email and through the use of the DTRL share drive. The WAM shall be notified immediately of any problems encountered in the laboratory or with the results obtained. These data shall include any generated data files (i.e., logged data) properly annotated, reports of the experimental conditions, calibration checks, measured variables, and a listing of the samples awaiting further analysis.

4. Analyze the data per the requirements in the QAPP and in consultation with the WAM, report the results of these analyses as soon as possible via email and through the use of the DTRL share drive. The expected data analyses would be in the form of Excel spreadsheets or other appropriate software.

5. Meet with the WAM at least every week to provide a project status update. The update shall include a synopsis of activities taking place the past week, problems encountered, and work planned for the next week.

6. Update the health and safety research protocols, as needed, as required by the EPA Facility and APPCD safety personnel. Updates to these protocols shall be approved by the EPA WAM and safety personnel prior to the commencement of any testing. The

contractor shall provide a copy of the health and safety plan to the WAM and the ORD-Safety Office for discussion.

7. Prepare monthly reports to EPA that summarize work activities (accomplished and planned) in this work assignment, including the status of applicable test, QA, and safety plans. The monthly report shall also detail labor costs and ODC charges. The ODC charges shall be documented in the report in a way that the items purchased, vendor, and cost are clearly indicated.

8. Prepare a draft test report and final report. The scope of the report shall be similar to previous EPA published reports. See, for example, U.S. EPA Report 600/R-14/208, titled "Decontamination of a Mock Office Using Chlorine Dioxide Gas".

VIII. DELIVERABLE SCHEDULE

The following table outlines the expected schedule that the contractor shall meet for the period covered by this SOW. The schedule assumes a start date of April 1, 2015. Dates dependent upon completion of specific tasks shall be updated based on discussions between the contractor WAL and EPA WAM during the development of the test plans to cover the work specified herein.

Suggested Deliverable Schedule

Deliverable	Completion Date
Submit work assignment plan	4/15/16
Complete Task 1 experiments	7/1/16
Submit first draft test report	7/15/16
Complete other tasks	ongoing

IX. REPORTING REQUIREMENTS

- The monthly invoice reports for this work assignment shall provide a detailed description of any equipment or expendables that have been purchased by the contractor for use on the projects discussed herein.

- All data and analyses worksheets generated as discussed in Section VII. shall be provided in electronic format in Excel and/or other appropriate software, in consultation with the WAM.

X. QUALITY ASSURANCE

The Tasks outlined in this PWS shall be conducted according to the existing QAPP entitled Fogging of Sporicidal Liquids, QA approval date 11/20/2015.
Additional information related to QA requirements can be found at www.epa.gov/quality.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-082

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base X Option Period Number	

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Russell Wiener	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-1910 FAX Number: 919-541-0496
Project Officer Name Robin Baily	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:
Other Agency Official Name	(Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Mark Cranley	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Use of Water Treatments to Inhibit Resuspension of Anthrax Spores

WA #: 1-082 WACOR: Russell Wiener

Contract #: EP-C-15-008 Alternate WACOR: Marshall Gray

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

Statement of Work (SOW):

(A) Goal/Purpose: The goal of this work is to compare and characterize the resuspension of bacterial spores off of outdoor surfaces that have and have not been treated to suppress reaerosolization. This task will support the goals of the SPORE Program.

(B) Background Information: In the event of a release of biological material in an urban area that would require decontamination for the purpose of public safety, the potential of resuspension of said materials is of great interest to EPA and the Department of Homeland Security. In such an event, a wide range of surfaces would be contaminated. The Environmental Protection Agency (EPA) has the responsibility for protecting human health and the environment from secondary emission of materials from these areas. EPA may be required to mitigate, provide consequence management, and decontaminate the area of concern. To this end, the EPA Office of Research and Development (ORD) National Homeland Security Research Center (NHSRC), Decontamination and Consequence Management Division (DCMD) is conducting research to investigate the resuspension of surrogate spores in the Aerosol Test Facility (ATF).

Long-Term Goal 2: The Office of Solid Waste and Emergency Response and other clients use Homeland Security Research Program products and expertise to improve the capability to respond to terrorist attacks affecting buildings and the outdoor environment and APG (41) - The Homeland Security Research Program will deliver reports and databases with information on the movement and the health effects of contaminants form the basis of the need for this work.. The information is instrumental for containing contamination and mitigating health effects. Determination of the bacterial spore (Anthrax spore surrogates) resuspension efficiency is necessary based on the historic release of Anthrax by terrorists in the

US and the lack of data demonstrating the ability of spores to resuspend in quantities of public health concern. The purpose of this Work Assignment is to help determine an appropriate simulant spore for Bacillus anthracis as well as determine the effectiveness of reaerosolization suppression methodologies related to support field decontamination programs. The U.S. Environmental Protection Agency (EPA)/National Homeland Security Research Center (NHSRC) will support this work Statement of Work (SOW).

Work will be conducted at EPA. Information obtained during this work will inform the following issues:

- understand the impact of wetting on resuspension
- make a quantitative comparison between wet and dry surfaces

(C) Statement of Work/Tasks: The Contractor shall:

A series of reports have be produced by EPA on prior studies quantitate the resuspension of spores and other surrogates from common outdoor surfaces. A set of laboratory experiments has been completed studying the degree of resuspension of bar-coded BtK spores under a variety of test conditions. EPA wishes to continue and expand these experiments to characterize the effect of wetting and high relative humidity on the level of applied resuspension forces to the surface needed to remove the spores. The methodologies to apply the spores and the data set for the forces required to resuspend spores from the test surfaces will be provided by EPA upon request. The specific coupon types selected will be based on the results of the previous work done for EPA and will also be provided upon request. All prior reports and documentation for prior studies conducted for EPA will be made available to the contractor upon request.

Microbiological organisms, supplies, and analyses shall be conducted under a separate WA. Under the current WA, the contractor shall notify the EPA WAM of all microbiological tasks required for the completion of this work assignment as part of the Work Plan development process. Samples will be delivered within the amount of time specified in the QAPP. The referenced documents attached below, available through the COR, will be utilized for biological sampling, quality assurance.

The Contractor shall provide a new table of deliverables and a timeline for the work to be performed within 30 days of the initiation of this Work Assignment.

Task 1: Validation of an inert test particle:

The Contractor shall conduct laboratory experiments to compare the degree of resuspension of an inert aerosol (fluorescent died PSL) under a subset of test conditions that have been conducted and reported on in past experiments by EPA. The report elucidating these experiment shall be available to the contractor from EPA upon request. The test design should be utilized to limit the number of test points needed for characterization and comparison to the results currently available on Btk spores. These tests shall be performed by the Contractor in the ATF in RTP, NC.

Date of Completion: July 31, 2016.

Task 2: The impact of coupon wetting on spore resuspension:

The Contractor shall use barcoded Btk as the surrogate for Ba reaerosolization utilizing the methodology developed in in prior experiments conducted for EPA. The effect of coupon wetting shall be studied. The Contractor shall determine that the coupons are fully saturated and have a known amount of free water on them. The water shall be applied after depositing the test aerosol on the coupon in the same manner as used in prior experiments conducted for EPA. A subset of the coupon types utilized in in prior experiments conducted for EPA shall be tested. The specific coupon types selected will be based on the results of the previous in prior experiments conducted for EPA and the determination of significant differences between coupon types on reaerosolization. If time permits, the effect of adding surfactant and or Sporicide to the water shall be studied. As directed by the WACOR, through written technical direction, the contractor shall make minor design or redesign new or existing equipment as research requirements change. Substantive changes to the work will be made by the WACOR through WA Amendments. All documentation regarding prior experimental work is available upon request from EPA.

Date of Completion: September 31, 2016.

Task 3: Effect of rain washdown on spore fate and transport:

The Contractor shall use barcoded Btk as the surrogate for Ba reaerosolization utilizing the methodology developed in in prior experiments conducted for EPA. The effect of rain washdown on coupons shall be studied. The water shall be applied after depositing the test aerosol on the coupon in the same manner as used in prior experiments conducted for EPA. A subset of the coupon types utilized in in prior experiments conducted for EPA shall be tested. The specific coupon types selected will be based on the results of the previous in prior experiments conducted for EPA and the determination of significant differences between coupon types on reaerosolization. If time permits the amount of Btk resuspended during washdown shall also be measured. As directed by the WACOR, through written technical direction, the contractor shall make minor design or redesign new or existing equipment as research requirements change. Substantive changes to the work will be made by the WACOR through WA Amendments. All documentation regarding prior experimental work is available upon request from EPA.

Date of Completion: March 31, 2017.

Task 4: Data Analysis and Final Reporting:

The Contractor shall build upon prior reporting to further the interpretation of the test study results and provide a non-dimensional analysis (similitude analysis). The contractor shall provide statistical analysis of the data utilizing methods such as Anova and PCA to determine the key test parameters impacting spore resuspension.

Date of completion March 31, 2017.

Task 5: Statistical Analysis and Technical Editing: If time and funding permit the Contractor shall interpret study results from prior and concurrent work conducted by NHSRC and utilize this information and data to determine (and where necessary test) new hypotheses relevant to study results. The contractor shall provide all necessary statistical and technical editing support for NHSRC projects.

Date of Completion: March 31, 2017.

Task 6: Laboratory Maintenance and Management:

The contractor shall be responsible for instrument, technical and scientific facility upkeep for the Aerosol Test Facility (ATF) including, but not limited to: repair, assembly, installation (including setup, calibration or alignment, testing and verification of proper operation); maintenance; calibration; preparation of reports which identify and describe the detail of damaged or missing articles and any other apparent impacts of equipment, facility, or laboratory use or misuse; coordination of any remedial maintenance or repair required, and resolution of any technical or operational problems with the equipment manufacturer or appropriate entity. The contractor shall be provided with the necessary operator's manuals, diagnostic software (when available), and training (when provided by the vendor). The contractor shall maintain and repair all shared and government furnished equipment provided under this work assignment. The contractor shall track the location of all equipment assigned to the Aerosol test facility and assist in custodial reporting.

Date of completion March 31, 2017.

The Contractor shall prepare monthly reports to EPA that will summarize the work activities (accomplished and planned) in this work assignment, including the status of applicable test, QA, and safety plans. The QAPP produced for prior studies by EPA may be utilized as a basis for the QAPP for this work assignment if applicable. The monthly report shall also detail labor costs and ODC charges. The ODC charges shall be documented in the report in a way that the items purchased, vendor, and cost are clearly indicated.

(D) Deliverables and Project Schedule, Acceptance Criteria:

- Work Plan. A work plan containing a cost estimate shall be provided to the Contracting Officer (CO), PO and WACOR within 30 days of the Contracting Officer's signature. A Quality Assurance Project Plan (QAPP) shall be provided within 90 days. The Contractor shall develop a QAPP following the EPA Guidance for Quality Assurance Project Plans and Modeling (QA/G-5M) and Guidance for Quality Assurance Project Plans (QA/G-5) which can be found at http://www.epa.gov/quality/qa_docs.html. 2. A final report shall be provide to the WACOR on or before March 31, 2016.

(E) QA/QC Requirements for WA: Calibrations of scientific instruments shall be performed under existing Standard Operating Procedures. Standard "good laboratory practices" for maintaining notebooks shall be employed.

(F) Special Requirements: The contractor shall modify the work plan to cover all tasks through the WA end date. The hours and costs shall be broken down by tasks. The contractor shall modify the work plan to cover all tasks through the WA end date. The hours and costs shall be broken down by tasks. The contractor shall modify the QAPP in accordance with http://www.epa.gov/quality/qs-docs/r5-final.pdf or based on the additions to the research that is being conducted. For guidance on preparing a research-specific QAPP, the preparer should refer to the project specific requirements provided in NHSRC's QMP. The QAPP must be approved prior to the start of any laboratory work. Additional information related to QA requirements can be found at www.epa.gov/quality.

(G) Reports and Meetings:

Need	Meeting Purpose	Frequency
X	to discuss workplan	Once
X	to review data or analyses	Weekly
X	to review monthly cost report	Monthly

(H) Travel/Training Requirements: Travel is anticipated to be charged under this work assignment. If travel is anticipated, the dates and circumstances necessitating travel chargeable to this work assignment will be specified by Technical Directive. Travel will be reviewed and approved by the WACOR. Requests for travel shall include: (1) name of traveler(s) and job duties, (2) description of circumstances necessitating travel, (3) location of travel, and (4) estimated cost breakdown by categories

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-083

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — **Accounting and Appropriations Data** — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Worth Calfee
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7600
FAX Number: 919-541-0496

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

PERFORMANCE WORK STATEMENT

EVALUATION OF COMPOSITE-BASED SURFACE SAMPLING METHODS

HS 7.52.02 – 541

TABLE OF CONTENTS

I	TITLE	1
II	PERIOD OF PERFORMANCE	1
III	SUMMARY OF OBJECTIVES	1
IV	RELEVANCE	1
V	BACKGROUND	1
VI	SCOPE	1
VII	TECHNICAL APPROACH	1
VIII	FACILITIES AND MATERIALS	2
IX	TASKS	2
X	MILESTONES, DELIVERABLES, AND COMPLETION DATES	4
XI	RESPONSABILITIES	4

I. TITLE

Evaluation of Composite-Based Surface Sampling Methods

II. PERIOD OF PERFORMANCE

The period of performance for this Work Assignment (WA) is from April 1, 2016 to March 31, 2017.

III. SUMMARY OF OBJECTIVES

The proposed work will evaluate the relative recovery efficiencies of currently recommended surface sampling devices and methods, when utilized in a discrete manner and when utilized for composite sample collection. The ultimate object is to generate data that can be used to select appropriate sampling devices following a bioterror event. Scientifically-testing sampling methods will provide increased confidence in the ability to characterize contamination following such an event.

IV. RELEVANCE

The products will be used to guide decisions with regard to the selection and application of candidate sampling technologies and methods for characterization of contamination post bioterror incident. The results of this work will be made available through published reports, journal papers, and/or conference abstracts and presentations.

V. BACKGROUND

Methods for detection and characterization of biological agent on surfaces following a bioterror incident include swabs, wipes, and vacuum. These methods are currently deployed on a discrete basis, whereby one sample is collected from one (~ 1ft^2) sample area. Composite-based sample collection, the use of one sampling media to collect samples from >1 sample area, can reduce material and labor costs, and improve response/recovery timelines. Currently, the recovery efficiency of currently recommended surface sampling methods (sponge wipes and 37mm vacuum cassettes) are unknown when applied to multiple sample locations of surface materials common to indoor or outdoor environments.

VI. SCOPE

Under this PWS, the contractor, under the direction of the Environmental Protection Agency (EPA), shall perform a study to evaluate discrete and composite sampling, when using the sponge wipe and 37mm cassette-type vacuum-based sampling device, for collection of biological agent from environmental surfaces.

VII. TECHNICAL APPROACH

A known quantity of *Bacillus* spores will be deposited by aerial dispersion onto large coupons (1 ft.^{2} or greater) containing carpet. The coupons will then be subjected to discrete or composite-based sampling. Recovery will be determined for each sampling method according to culture-based microbiological assays developed by EPA and CDC. All test parameters, such as test chamber size, coupon materials and sizes, sampling methods, methods of extraction / analysis will be determined by agreement among the

EPA project team. The collective set of tests must be able to be completed within the allotted budget.

Table 1. Potential test parameters to vary during experiments

Parameter	Potential Variants
1. Material Surface Types	Carpet (vacuum only), Tile and Drywall (Sponge only), Concrete (both devices)
2. Coupons and Replicates	The number of replicates shall be determined by the amount of effort and funding available.
3. Sampled Area	Three sample area sizes
4. Spore Concentration on Surfaces	Two surface concentrations. (i.e., E6 – E7 ft^{-2}, and E2 – E3 ft^{-2})

VIII. FACILITIES AND MATERIALS

All tasks described in this PWS shall be performed in-house, at the EPA's Research Triangle Park (RTP) facilities at 109 T.W. Alexander Dr., unless approved otherwise by the EPA WAM. The sampling activities shall be conducted in the NHSRC's Decontamination Technologies Research Lab (DTRL) located in H-224, H-222, H-122a, and H-130a. The lab contains the necessary equipment for the tasks described herein. The analysis of the biological samples shall be conducted in the Microbiology lab, located in E-386, E-388, and E-390.

IX. TASKS

To achieve the desired objective of this effort, work for this PWS can be broken down into three tasks. These tasks are a continuation of the testing outlined in the QAPP developed during option 4 (Work Assignment 4-10)

Task 1. QAPP Development

The contractor shall prepare a QAPP in accordance with Quality Assurance (QA) Category_B_. Attachment 1 to the PWS provides information regarding NHSRC QA Requirements/Definitions List.

QAPPs being developed for Category A (formerly Category 1 or 2) projects must be developed in accordance with the document titled "EPA Requirements for Quality Assurance Project Plans." EPA QA/R-5 can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf. At the discretion of the COR, a Category B (formerly category 3) QAPP can be developed based on the R5 guidance or a project-specific QA requirements provided on the NHSRC@work website.

The QAPP must be approved prior to the start of any literature searches (existing data), data collection, gathering, synthesizing, or data generation (laboratory) work. Additional information related to QA requirements can be found at www.epa.gov/quality.

Task 2. Fabrication of Test Material Coupons
Materials shall fashioned into 14" x 14" coupons for testing. Details shall be provided at the time of the work request.

Task 3. Test Experimentation
Sampling devices (sponge stick and 37mm cassette) shall be evaluated for collection of biological agent (non-pathogenic *Bacillus* spores, as surrogate for *Bacillus anthracis*) from material surfaces. Agent will be deposited onto coupon surfaces by the aerosol deposition method developed by NHSRC. Two or Three material types shall be tested for each sampling device. For these tests, experimentation shall be carried out in accordance with the QAPP. Deviations from the QAPP shall be documented in writing and justified.

Task 5. Report Preparation.
Following completion of all data collection, a comprehensive report shall be prepared documenting the details of the tests, including methods, quality control measures utilized, collected data, interpreted results, and conclusions. The report shall follow standard EPA NHSRC report style, and therefore shall conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

Table 2. Example Test Matrix

Device	Sampled Area (#areas x ft^2 each)	Material Types	Spore Surface Concentration	Replicates
Sponge Wipe	1 x 1	Drywall	E6 – E7 ft^{-2}, and E2 – E3 ft^{-2}	5 experimental (per test condition) 3 negative (per material per test day) 3 stainless steel inoculation controls (per test day)
		Tile		
		Concrete		
	4 x 1	Drywall		
		Tile		
		Concrete		
	8 x 1	Drywall		
		Tile		
		Concrete		
37mm Vacuum Cassette	1 x 1	Carpet		
		Concrete		
	4 x 1	Carpet		
		Concrete		
	8 x 1	Carpet		
		Concrete		

X. MILESTONES, DELIVERABLES, AND COMPLETION DATES

QAPP Amendment
A draft QAPP and Work Plan shall be provided within 30 days of the award of this agreement. This shall be provided prior to commencement of the tests described within this PWS. The combined QAPP and Work Plan shall include scope, scheduling, and costing information for each of the tests planned.

Reporting
A Draft Report shall be provided to EPA for review by March 1, 2017. A final report shall be provided 10 business days after EPA comments.

XI. RESPONSIBILITIES

This project is initiated by the USEPA Office of Research and Development, National Homeland Security Research Center (NHSRC), Decontamination and Consequence Management Division (DCMD) in Research Triangle Park, NC. This project is a collaborative effort with the US Centers for Disease Control and Prevention in Atlanta, GA. The U.S. EPA WACOR shall be Dr. M. Worth Calfee (phone 919-541-7600, email calfee.worth@epa.gov). Dr. Sang Don Lee shall be alternate WACOR.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-084

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund

Accounting and Appropriations Data

[X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Stuart Willison
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-569-7253
FAX Number:

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Statement of Work

WA Title: **Developing Remediation Tools, Including Surface Wipe Sampling Methods, for Evaluating Indoor Contamination from Pesticide Misuse**

Short Title: **Pesticide Misuse Tools**

WA #: 1-084 WACOR: Stuart Willison

Contract #: EP-C-15-008 Alternate WACOR: Emily Snyder

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of the award through March 31, 2017.

SUMMARY OF OBJECTIVES

The objectives of this effort are to develop sampling, analytical and assay methods to determine if surface pesticide residues present before and after decontamination procedures are below a health-based threshold value and determine optimum methods for decontamination of these pesticides in indoor environments. The approach will provide a flexible, but consistent, set of guidelines to better understand the application and interpretation of data for each method during the remediation phases of an incident. Furthermore, a more complete understanding and confidence in the data collected will assist decision-makers when attempting to clear a contaminated site intended for civilian reoccupation.

BACKGROUND

There has been an increase in reported pesticide misuse incidents for controlling bed bugs and other insects in indoor environments. These incidents include pesticide products not registered by the EPA for indoor use or approved pesticide products that are applied improperly or at concentrations that far exceed the labeled rates. The bed bug epidemic is expected to result in a growing number of incidents; however, infestation from multiple sources will seemingly be a problem before and after any specific incident, such as bed bugs, is identified. EPA Regional Offices are often called on to assist local communities in remediating homes and businesses following indoor misapplications where pesticide levels may be unsafe. To date, there are no tools for adequately evaluating pesticide residues on indoor surfaces to determine potential risk to occupants, and no effective cleaning procedures to reduce pesticide levels in affected structures. Therefore, occupants continue to inhabit contaminated buildings, or are forced to vacate contaminated properties, or attempt decontamination themselves, which may create more toxic byproducts or further dispersing contamination. Pesticide manufacturers and the Office of Pesticide Programs offer little assistance when these products are applied illegally or in unintended ways.

Federal, state and local agencies responding to pesticide incidents regularly seek guidance about interpreting indoor surface wipe sample results. Current practices for collecting, processing, and

analyzing surface wipe samples for indoor pesticide incidents vary with respect to wipe material and size, selection and amount of wetting agent, template size, wiping technique, and types of sampled surfaces, among other factors. Such variations exist because of numerous wipe sampling methods, each utilizing slightly different materials and standard operating procedures. Beyond numerous standard operating procedures that exist, sampling practices vary widely, even at the federal, state, and local levels. Because of the variability at all levels, there is no overwhelming consensus for sample collection wipe procedures for the wider range of pesticides and surfaces encountered, particularly for indoor misuse situations[1234], with relatively little known about the reliability and comparability of the different wipe sampling materials, techniques and incorporated methods. As a result, it is difficult to compare and interpret data results obtained through different methods, so assessing and responding to incidents is challenging and will complicate incident response. If wipe samples provide the basis for critical decisions about evacuation and remediation actions, it is important to better understand sampling, processing, and analysis variables and limitations, and have a more consistent set of guidelines.

Although limited, current research indicates that many variables associated with the surface sampling process affect residue removal efficiency, precision and accuracy. Very little is known about how the different methods compare for reliability and validity. Recent research conducted by the National Exposure Research Laboratory (NERL) associated with a separate pesticide RARE project identified concerns with residue recovery when dealing with high surface concentrations as typically encountered in pesticide misuse cases. Additional questions became relevant when attempting to address the need for different methods to detect low versus high surface residues to capture more accurate information and to avoid underestimating exposures. Currently NERL has examined standardizing techniques for the collection of low concentrations of pesticide residues, and has developed wipe extraction procedures. NERL has continued to explore and evaluate wipe techniques across different concentrations and the influence of pesticide formulations and sample wipe efficiency from different residential surfaces.

Recent research conducted by the National Homeland Security Research Center (NHSRC) includes the development of wipe sampling and analysis methods for chemicals, including pesticides that are of a primary concern from a homeland security perspective. Most concentration levels investigated are low, but higher concentrations should also be investigated to ensure that dedicated wipe sampling and analysis procedures used during the characterization and decontamination phases of an incident will work as intended. Wipe sampling and analysis methods have been developed with a particular focus on certain challenges that are common for such procedures, including: wipe selection, wetting solvents, different morphologies, and porosity of the wiped surfaces. In addition to wiping surfaces, wipe

---

[1] *American Healthy Homes Survey: A National Study of Residential Pesticides Measured from Floor Wipes*, D. M. Stout II, et al. *Environ. Sci. Technol.* **2009**, 43, 4294-4300.

[2] *Sampling of Common Pesticides and PCBs from Inert Surfaces,* EPA/330/1-90-001, October 1989, B. L. Carr and D. F. Hill, National Enforcement Investigations Center, Denver, CO.

[3] *A Literature Review of Wipe Sampling Methods for Chemical Warfare Agents and Toxic Industrial Chemicals,* EPA/600/R-07/004, January 2007, Prepared by Battelle, Columbus, OH 43201, for Stephen Billets, U.S. Environmental Protection Agency, Office of Research and Development National Exposure Research Laboratory, Environmental Sciences Division, Las Vegas, NV 89119.

[4] *Comparison of wipe materials and wetting agents for pesticide residue collection from hard surfaces,* N.C. Deziel, et al. Sci. of the Total Environ. **2011**, 409, 4442-4448.

extraction procedures will also need to be developed and followed for data comparability amongst the many labs analyzing potentially hundreds of thousands of generated samples throughout the remediation phase of an incident.

SCOPE

The scope of this WA is to investigate important wiping parameters and how they affect recovery efficiencies by generating extracts from the wipe sampling studies and from small coupon decontamination testing.

TECHNICAL APROACH/OBJECTIVES

Details for the general technical approach can be found below. The contractor shall conduct wipe sampling efficiency studies in phases that study the impacts of specific variables, including, but not limited to wipe material, wipe solvent, and pesticide formulations. Each tested variable is further described within the phases described in QAPP.

The contractor shall perform the following tasks for this work assignment:

TASK 1. DEVELOPMENT OF THE QAPP

The contractor shall prepare a QAPP in accordance with Quality Assurance (QA) Category III. Attachment 1 to the Performance Work Statement (PWS) provides information regarding **NHSRC QA Requirements/Definitions List.**

If a Category I or II QAPP is required, it must be developed in accordance with the document titled "EPA Requirements for Quality Assurance Project Plans." EPA QA/R-5 can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf. At the discretion of the COR, a Category III QAPP can be either based on the R5 guidance or a project-specific QA requirements provided on the NHSRC@work website.

The **QAPP** must be approved prior to the start of any literature searches (existing data), data collection, gathering, synthesizing, or data generation (laboratory) work. Additional information related to QA requirements can be found at www.epa.gov/quality.

The contractor must prepare a Quality Assurance Project Plan for approval by NHSRC. Work on NHSRC tasks cannot proceed until the contractor receives notification from the PO via e-mail that utilization of the QAPP is approved for use.

The contractor shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this extramural action, see attachment #1 and #2. The EPA WAM, in concert with the project team, will prepare a amend an existing QAPP in accordance with http://www.epa.gov/quality/qs-docs/r5-final.pdf and the NHSRC Quality Assurance (QA) requirement as defined in Attachment #2 to the SOW. A draft of the QAPP will be provided for comments to the contractor before review by the EPA Quality Assurance Manager. The contractor and EPA WAM shall respond to comments and submit the QAPP for approval to the EPA Quality Assurance Manager. The QAPP, including any amendments, shall be approved by the U.S. EPA in writing (e.g., signature on the

approval page) prior to the start of any work. Additional information related to QA requirements can be found at: http://www.epa.gov/quality/qs-docs/r5-final.pdf.

Deliverables: Quality Assurance Project Plan (QAPP).

Task 2: Wipe Sampling:

The contractor shall conduct a series of experiments focusing on the analytes listed in Table 1 for Phase 1. Other pesticides can be used to replace those listed in Table 1 prior to initial testing, but the number of total tested analytes will not change once testing begins. The chosen pesticides will be applied to three different wipes, one of which will be determined to be a preferred wipe based on efficiencies for recovering pesticides of interest from a previous investigation. The two remaining wipes will be chosen based on availability from commercial vendors and preferred wipe type for field samplers. All three wipes will be subjected to at least the 2 solvents listed within Phase 1 to determine which wetted solvent would more efficiently recover the analyte of interest. Phase 1 will narrow down a preferred wipe type and wetting solvent for optimal analyte recovery and this test matrix can be found in Table 1. After the completion of Phase 1, the contractor shall complete Phase 2 which will apply the chosen wipe and wetting solvent to a series of experiments focusing on the number of wipes to be used when collecting samples subjected to different analyte concentrations on a surface. This test matrix is outlined in Table 2. Lastly, Phase 3 will investigate the recovery efficiency of the target analytes from different surfaces and compare the data to the previous Phases for comparison on a metal surface. This phase includes investigation of wipe sampling for neat chemical vs. pesticide formulation as a function of surfaces, and potentially solvents and this test matrix can be found in Table 3. Each Phase will be performed separately and discussed at the completion to ensure proper selections prior to beginning the next Phase. Furthermore, funds shall be added as needed to ensure completion of each Phase and any modifications, which may be needed to ensure proper investigations are performed.

Table 1 - Phase 1, Test matrix to examine wipe type and solvent for stainless steel.

Pesticide	Solvent	Wipe Type* (COTS)	Wipe Type* (COTS)	Wipe Type* (COTS – TBD- e.g., IPA-prewetted wipe)
Malathion	Solvent 1 (IPA)	5 test wipes, 1 wipe spike, 1 wipe blank	5 test wipes, 1 wipe spike, 1 wipe blank	5 test wipes, 1 wipe spike, 1 wipe blank
	Solvent 2 (Acetone)	5 test wipes, 1 wipe spike, 1 wipe blank	5 test wipes, 1 wipe spike, 1 wipe blank	5 test wipes, 1 wipe spike, 1 wipe blank

	Solvent 1 (IPA)	5 test wipes, 1 wipe spike, 1 wipe blank	5 test wipes, 1 wipe spike, 1 wipe blank	5 test wipes, 1 wipe spike, 1 wipe blank
Carbaryl	**Solvent 2 (Acetone)**	5 test wipes, 1 wipe spike, 1 wipe blank	5 test wipes, 1 wipe spike, 1 wipe blank	5 test wipes, 1 wipe spike, 1 wipe blank

Table 2. Phase 2, Down select solvent to study Phase 2.

If down selection of wipe is not possible, then Phase 2 may be discussed as follows for each Wipe Type as listed in Table 2. If down selection is possible, then only one Wipe Type will be tested. If not, then multiple, if not all wipes, will need to be carried forward from Phase 1. As a result, the medium concentration may be dropped to focus on the extreme concentration ranges (high and low). A tentative Phase 2 plan is as follows:

Pesticide	Wipe/Solvent (IPA)	Low concentration	Medium concentration (may be unnecessary and dropped if not needed)	High concentration
-	Wipe	COTS	COTS	COTS
-	Wipe (if necessary)	COTS	COTS	COTS
-	Wipe (if necessary)	COTS	COTS	COTS
Malathion	*2 wipes per coupon for low (and medium) surface concentration test; wipes extracted analyzed separately	*2x3 test wipes (Wipe Type 1), 1 wipe spike, 1 wipe blank	*2x3 test wipes (Wipe Type 1), 1 wipe spike, 1 wipe blank	*3x3 test wipes (Wipe Type 1), 1 wipe spike, 1 wipe blank

	*3 wipes per coupons for high surface concentration test; wipes extracted analyzed separately Wetting solvent and wipe type – selected based on Phase 1 results	*2x3 test wipes (Wipe Type 2), 1 wipe spike, 1 wipe blank	*2x3 test wipes (Wipe Type 2), 1 wipe spike, 1 wipe blank	*3x3 test wipes (Wipe Type 2), 1 wipe spike, 1 wipe blank
Carbaryl	*2 wipes per coupon for low and medium surface concentration test; wipes extracted analyzed separately *3 wipes per coupons for high surface concentration test; wipes extracted analyzed separately Wetting solvent and wipe type – selected based on Phase 1 results	*2x3 test wipes (Wipe Type 1), 1 wipe spike, 1 wipe blank *2x3 test wipes (Wipe Type 2), 1 wipe spike, 1 wipe blank	*2x3 test wipes (Wipe Type 1), 1 wipe spike, 1 wipe blank *2x3 test wipes (Wipe Type 2), 1 wipe spike, 1 wipe blank	*3x3 test wipes (Wipe Type 1), 1 wipe spike, 1 wipe blank *3x3 test wipes (Wipe Type 2), 1 wipe spike, 1 wipe blank

Depending on the number of wipes carried forward from Phase 2 into Phase 3, the number of tested surfaces could change from 3 to 2. For example, if 2-3 wipes are tested in Phase 2, then only 1-2 surfaces will be tested in Phase 3. Neat chemicals and their formulation products will be tested in Phase 3 as listed in Table 3.

Table 3. Phase 3, down select number of wipes and potential concentration to study Phase 3

Pesticide	**Solvent(s)**	**Surface 1*(required)**	**Surface 2***	**Surface 3 (stainless steel)***
Malathion	**TBD**	5 test wipes, 1 wipe spike, 1 wipe blank, 1 surface blank	5 test wipes, 1 wipe spike, 1 wipe blank, 1 surface blank	5 test wipes, 1 wipe spike, 1 wipe blank, 1 surface blank
Carbaryl	**TBD**	5 test wipes, 1 wipe spike, 1 wipe blank, 1 surface blank	5 test wipes, 1 wipe spike, 1 wipe blank, 1 surface blank	5 test wipes, 1 wipe spike, 1 wipe blank, 1 surface blank
Malathion Formulation	**TBD**	5 test wipes, 1 wipe spike, 1	5 test wipes, 1 wipe spike, 1	5 test wipes, 1 wipe spike, 1

		wipe blank, 1 surface blank	wipe blank, 1 surface blank	wipe blank, 1 surface blank
Carbaryl Formulation	**TBD**	5 test wipes, 1 wipe spike, 1 wipe blank, 1 surface blank	5 test wipes, 1 wipe spike, 1 wipe blank, 1 surface blank	5 test wipes, 1 wipe spike, 1 wipe blank, 1 surface blank

The wipes containing the target pesticides will be extracted in the appropriate solvent via sonication in a TBD solvent prior to initial testing in Phase 3.

WA SPECIFIC EQUIPMENT

ANALYTICAL SUPPORT

Under this task the contractor shall dry down all of the extracts that are balanced in TBD solvent as outlined in the QAPP "Developing Remediation Tools and Approaches to Address Indoor Contamination from the Misuse of Pesticides for Bed Bug Control". A solvent (e.g., methanol or acetonitrile) conducive for use with LC/MS applications will be applied to samples in place of hexane if LC is needed over GC. The contractor shall also prepare instrument detection limit standards (10) and calibration standards (5 per pesticide) for both GC/MS and LC/MS/MS of the samples. The specifications for these standards shall be provided by the EPA WAM. The contractor shall also add the internal standards (provided by the EPA WAM) to all of the vials that will be analyzed by GC/MS or LC/MS/MS prior to delivering them to the analytical laboratory.

All experiments and sample preparation of samples for the project described in this statement of work shall be performed at the U.S. EPA's facilities located at 109 TW Alexander Dr, Research Triangle Park, NC. Testing is anticipated to be performed in a chemical hood in H-210 and chemical analyses of the samples are expected to also occur in Research Triangle Park, NC, under this PWS.

The technical risk involved in this project is considered to be moderate. Prior goals evaluated malathion, carbaryl, fipronil, deltamethrin, and permethrin. Current goals will be to further validate surface wipe and extraction methods for assessing residual pesticide levels depending on the chemical and or wiping material. Either existing chemicals will be used, but different testing parameters will be altered, or new chemicals of concern and/or formulations for any of the pesticides will be evaluated. These goals are a low technical risk. All information obtained is expected to be relevant.

QUALITY ASSURANCE

A draft test/QA plan for these experiments will be provided by the EPA WAM prior to commencement. This test/QA plan shall be finalized by the contractor. See Task 1 above. The work was completed prior to the amendment and will be used for all investigations for the current work assignment through from April through March 31, 2017.

DELIVERABLES

On a monthly basis for the duration of the project, the contractor shall submit, in electronic format, progress reports summarizing technical progress (including estimated percent of project completed), problems encountered, cumulative financial expenditures and cost and schedule variance. The contractor shall also have bi-weekly meetings with the EPA WAM and the project team for the duration of the WA.

The deliverables in the form of experimental details and extracts are shown in Table 4.

SCHEDULE of DELIVERABLES

Table 4: Deliverable Schedule

Task Number	Deliverable	Due Date
1	Comments Related to Review of Draft QAPP	1 month from WA award
2a	Extracts from Phases 1 for Wipe Sampling	60 days from QAPP approval
2b	Extracts from Phases 2 for Wipe Sampling	60 days from Phase 1 completion
2c	Extracts from Phases 3 for Wipe Sampling	60 days from Phase 2 completion

REPORTING REQUIREMENTS

- Data related to this project shall be stored on the US EPA server's DTRL shared drive. Electronic data for this WA should be minimal but may include titration data for decontamination solutions.
- Transfer of project data shall occur at the conclusion of each experiment within each task. Detailed written summaries of experimental procedures and results shall be provided to the WAM within one week from completion of the data analysis. These reports shall indicate the operational conditions (e.g. decontamination solution preparation procedure and exposure time)

Attachment 1: NHSRC QA Requirements/Definitions List

EPA=s Quality System Website: http://www.epa.gov/quality

EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

EPA's Quality System Website: http://www.epa.gov/quality/qs-docs/r5-final.pdf

In accordance with EPA CIO 2105.0 (Order), EPA 2105-P-01-0 (Manual), and conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation described herein. All Quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approve the quality documentation. The Quality Assurance Project Plan (QAPP) shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government.

NHSRC's Quality System Specifications for Extramural Actions –

These requirements typically pertain to single project efforts. The five specifications are:

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

NHSRC QA Requirements/Definitions List

Category Level Designations (determines the level of QA required):

- **Category I Project** - applicable to studies performed to generate data used for enforcement activities, litigation, or research project involving human subjects. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

- **Category II Project** - applicable to studies performed to generate data used in support of the development of environmental regulations or standards. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

- **Category III Project** - applicable to projects involving applied research or technology evaluations. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP: QAPP** requirements for the specific project type (see below).

- **Category IV Project** - applicable to projects involving basic research or preliminary data gathering activities. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP. QAPP** requirements for the specific project type (see below).

Project Types:

These outlines of NHSRC's QAPP Requirements for various project types, from Appendix B of the NHSRC QMP (except where otherwise noted), are condensed from typically applicable sections of R-5 (EPA Requirements for QA Project Plans) and are intended to serve as a starting point when preparing a QAPP. These lists and their format may not fit every research scenario and QAPP's must conform to applicable sections of R-5 in a way that fully describes the research plan and appropriate QA and QC measures to ensure that the data are of adequate quality and quantity to fit their intended purpose.

Applied Research Project - pertains to a study performed to generate data to demonstrate the performance of accepted processes or technologies under defined conditions. These studies are often pilot- or field-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Applied Research Projects" from Appendix B of the NHSRC QMP.

Design, Construction, and/or Operation of Environmental Technology Project - pertains to environmental technology designed, constructed and/or operated by and/or for EPA. The QAPP shall address requirements in the EPA Quality System document "Guidance on Quality Assurance for Environmental Technology Design, Construction, and Operation" G-11, at http://www.epa.gov/quality/QS-docs/g11-final-05.pdf. For additional information, you may refer to Part C of "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology," ANSI/ASQC E4-1994, American Society for Quality Control, Milwaukee, WI, January 1995.

Geospatial Data Quality Assurance Project - pertains to data collection; data processing and analysis; and data validation of geospatial applications. The QAPP shall address requirements in the EPA Quality System document "Guidance for Geospatial Data Quality Assurance Project Plans" G-5S at http://www.epa.gov/quality/QS-docs/g5g-final-05.pdf.

Method Development Project - pertains to situations where there is no existing standard method, or a standard method needs to be significantly modified for a specific application. The QAPP shall address all requirements listed in "QAPP Requirements for Method Development Projects" from Appendix B of the NHSRC QMP.

Model Development Project - includes all types of mathematical models including static, dynamic, deterministic, stochastic, mechanistic, empirical, etc. The QAPP shall address requirements in the EPA Quality System document "Guidance for Quality Assurance Project Plans for Modeling" G-5M at http://www.epa.gov/quality/QS-docs/g5m-final.pdf.

Sampling and Analysis Project - pertains to the collection and analysis of samples with no objectives other than to provide characterization or monitoring information. The QAPP shall address all requirements listed in "QAPP Requirements for Sampling and Analysis Projects" from Appendix B of the NHSRC QMP.

Existing Data Project - pertains to environmental data collected from other sources, by or for EPA, that are used for purposes other than those originally intended. Sources may include: literature, industry surveys, compilations from computerized databases and information systems, and computerized or mathematical models of environmental processes. The QAPP shall address all requirements listed in "QAPP Requirements for Secondary Data Projects" from Appendix B of the NHSRC QMP.

Software Development and Data Management Project - pertains to software development, software/hardware system development, database design and maintenance, data validation and

verification systems. The QAPP shall address all requirements listed in "QAPP Requirements for Software Development Projects" from Appendix B of the NHSRC QMP.

Definitions:

Environmental Data - These are any measurement or information that describe environmental processes, location, or conditions; ecological or health effects directly from measurements, produced from software and models, and compiled from other sources such as data bases or the literature. For EPA, environmental data include information collected directly from measurements, produced from software and models, and compiled from other sources such as data bases or literature.

Incremental Funding - Incremental funding is partial funding, no new work.

Quality Assurance (QA) - Quality assurance is a system of management activities to ensure that a process, item, or service is of the type and quality needed by the customer. It deals with setting policy and running an administrative system of management controls that cover planning, implementation, and review of data collection activities and the use of data in decision making. Quality assurance is just one part of a quality system.

Quality Assurance Project Plan (QAPP) - A QAPP is a document that describes the necessary quality assurance, quality control, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. A QAPP documents project-specific information.

Quality Control (QC) - Quality control is a technical function that includes all the scientific precautions, such as calibrations and duplications, which are needed to acquire data of known and adequate quality.

Quality Management Plan (QMP) - A QMP is a document that describes an organization's/program's quality system in terms of the organizational structure, policy and procedures, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, documenting, and assessing all activities conducted. A QMP documents the overall organization/program, and is primarily applicable to multi-year, multi-project efforts. An organization's/program's QMP shall address all elements listed in the "Requirements for Quality Management Plans" in Appendix B of the NHSRC QMP.

Quality System - A quality system is the means by which an organization manages its quality aspects in a systematic, organized manner and provides a framework for planning, implementing, and assessing work performed by an organization and for carrying out required quality assurance and quality control activities.

R-2. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001
http://www.epa.gov/quality/QS-docs/r2-final.pdf.

R-5. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001
http://www.epa.gov/quality/QS-docs/r5-final.pdf.

Substantive Change - Substantive change is any change in an activity that may alter the quality of data being used, generated, or gathered.

Technical Lead Person (TLP) - This person is technically responsible for the project. For extramural contract work, the TLP is typically the contracting officer's representative (COR). For intramural work, the TLP is typically the Principal Investigator.

Abbreviations:

COR	Contracting Officer's Representative	IAG	Interagency Agreement
NHSRC	National Homeland Security Research Center	QA	Quality Assurance
NRMRL	National Risk Management Research Laboratory	QAM	Quality Assurance Manager
QA ID	Quality Assurance Identification	QMP	Quality Management Plan
QAPP	Quality Assurance Project Plan	SOW	Statement of Work
QS	Quality System	CRADA	Cooperative Research & Development Agreement
TLP	Technical Lead Person		

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-085

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name: 1-085 Anthrax Field Study

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Russell Wiener
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-1910
FAX Number: 919-541-0496

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Draft Design of Anthrax Exposure Field Study to be Implemented Immediately after an Incident Utilizing Existing Methods

WA #: 1-NNN WACOR:

Contract #: EP-C-15-008 Alternate WACOR:

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

Statement of Work (SOW):

(A) Goal/Purpose: The goal of this work is to draft a field study design to be implemented after a biological incident in an urban area. This task will support the goals of the SPORE Program.

(B) Background Information: In the event of a release of biological material in an urban area that would require decontamination for the purpose of public safety, there is an immediate need to be able to collect information as to the extent of the area of contamination, the concentration of contaminants, and the primary and secondary dispersion of the contaminants. This information is important to both EPA and the Department of Homeland Security. In such an event, a wide range of surfaces would be contaminated. The Environmental Protection Agency (EPA) has the responsibility for protecting human health and the environment from secondary emission of materials from these areas and may be required to mitigate, provide consequence management, and decontaminate the area of concern. To this end, the EPA Office of Research and Development (ORD) National Homeland Security Research Center (NHSRC), Decontamination and Consequence Management Division (DCMD) is conducting research to develop guidance on post incident field monitoring.

Long-Term Goal 2: The Office of Solid Waste and Emergency Response and other clients use Homeland Security Research Program products and expertise to improve the capability to respond to terrorist attacks affecting buildings and the outdoor environment and APG (41) - The Homeland Security Research Program will deliver reports and databases with information on the movement and the health effects of contaminants form the basis of the need for this work.. The information is instrumental for containing contamination and mitigating health effects. Determination of the bacterial spore (Anthrax spore surrogates) dispersion and resuspension after the release of Anthrax by terrorists in the US is a major public health concern. The purpose of this Work Assignment is to help develop a field study design for a potential release of Bacillus anthracis spores. This field study would be used to help define and support field decontamination programs. The

U.S. Environmental Protection Agency (EPA)/National Homeland Security Research Center (NHSRC) will support this work Statement of Work (SOW).

(C) Statement of Work/Tasks: The Contractor shall:

The Contractor shall provide a new table of deliverables and a timeline for the work to be performed within 30 days of the initiation of this Work Assignment.

Task 1: Preparation of the Quality Assurance Project Plan (QAPP) [The COR or PO must provide the QA Category in the Performance Work Statement.]

This plan has been provided and will not be changed from the previous work assignment WA-085.

The contractor shall prepare a QAPP in accordance with Quality Assurance (QA) Category____3___. Attachment 1 to the Performance Work Statement (PWS) or Statement of Work (SOW) provides information regarding NHSRC QA Requirements/Definitions List.

A Category 1 or 2 QAPP must be developed in accordance with the document titled "EPA Requirements for Quality Assurance Project Plans." EPA QA/R-5 can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf. At the discretion of the COR, a Category 3 QAPP can be either based on the R5 guidance or a project-specific QA requirements provided on the NHSRC@work website. The appropriate project-specific QA requirement information must be provided by the COR as Attachment 2.

The QAPP must be approved prior to the start of any literature searches (existing data), data collection, gathering, synthesizing, or data generation (laboratory) work. Additional information related to QA requirements can be found at www.epa.gov/quality.

Task 2: Literature Review and Outline of the Draft Design of Anthrax Exposure Field Study to be Implemented Immediately after an Incident Utilizing Existing Methods:

The Contractor shall conduct a literature review regarding the design of field sampling studies for monitoring Biological and Chemical Agents. If necessary due to lack of prior documentation, this review may also include Radiological Agents. The Contractor shall also review all applicable field study monitoring methods currently available for the field study. The contractor shall develop a comprehensive outline of the field study design document for EPA review. The review that was completed in the WA 085 will be the basis of this review, but any information regarding work published in the past year may be added.

Initial Date of Completion: March 31, 2016. Additions due by Sept. 1, 2016.

Task 3: The Draft Design of an Anthrax Exposure Field Study to be Implemented Immediately after an Incident Utilizing Existing Methods:

The Contractor shall develop a Draft Design of an Anthrax Exposure Field Study to be Implemented Immediately after an Incident Utilizing Existing Methods. This should be a comprehensive design, including logistics, available standard operating procedures for the methods to be utilized in the study, sample protocols, data sheets, and all other pertinent data and information gathering methodologies to be utilized in the field operations.

Date of Completion: December 30, 2016.

Task 4: Data Analysis and Final Reporting:

The Contractor shall provide the EPA with a comprehensive final report including the draft study design, literature review, references, SOPs and all other supporting documents.

Date of completion March 31, 2017.

Task 5: Statistical Analysis and Technical Editing: If time and funding permit the Contractor shall interpret study results from prior and concurrent work conducted by NHSRC and utilize this information and data to determine (and where necessary test) new hypotheses relevant to study results. The contractor shall provide all necessary statistical and technical editing support for NHSRC projects.

Date of completion March 31, 2017.

The Contractor shall prepare monthly reports to EPA that will summarize the work activities (accomplished and planned) in this work assignment, including the status of applicable test, QA, and safety plans. The QAPP produced shall meet the requirements in Appendix B, below. The monthly report shall also detail labor costs and ODC charges. The ODC charges shall be documented in the report in a way that the items purchased, vendor, and cost are clearly indicated.

(D) Deliverables and Project Schedule, Acceptance Criteria:

- Work Plan. A work plan containing a cost estimate shall be provided to the Contracting Officer (CO), PO and WACOR within 30 days of the Contracting Officer's signature. A Quality Assurance Project Plan (QAPP) shall be provided within 90 days. The Contractor shall develop a QAPP following the EPA Gudiance for Quality Assurance Project Plans and Modeling (QA/G-5M) and Guidance for Quality Assurance Project Plans (QA/G-5) which can be found at http://www.epa.gov/quality/qa_docs.html. 2. A final report shall be provide to the WACOR on or before March 31, 2017.

(E) QA/QC Requirements for WA: See Appendix B below. Standard "good laboratory practices" for maintaining notebooks shall be employed.

(F) Special Requirements: The contractor shall modify the work plan to cover all tasks through the WA end date. The hours and costs shall be broken down by tasks. The contractor shall modify the work plan to cover all tasks through the WA end date. The hours and costs shall be broken down by tasks. The contractor shall modify the QAPP in accordance with http://www.epa.gov/quality/qs-docs/r5-final.pdf or based on the additions to the research that is being conducted. For guidance on preparing a research-specific QAPP, the preparer should refer to the project specific requirements provided in NHSRC's QMP. The QAPP must be approved prior to the start of any laboratory work. Additional information related to QA requirements can be found at www.epa.gov/quality.

(G) Reports and Meetings:

Need	Meeting Purpose	Frequency
X	to discuss workplan	Once
X	to review data or analyses	Weekly
X	to review monthly cost report	Monthly

(H) Travel/Training Requirements: Travel is not anticipated to be charged under this work assignment. If travel is anticipated, the dates and circumstances necessitating travel chargeable to this work assignment will be specified by Technical Directive. Travel will be reviewed and approved by the WACOR. Requests for travel shall include: (1) name of traveler(s) and job duties, (2) description of circumstances necessitating travel, (3) location of travel, and (4) estimated cost breakdown by ctegories

Appendix A REQUIREMENTS AND GUIDANCE

For Category I (enforcement, litigation, or projects involving human subjects) and Category II (development of environmental regulations or standards), NHSRC=s requirements are those listed in EPA Requirements for Quality Assurance Project Plans for Environmental Data Operations, EPA QA/R-5, EPA/240/B-01/003, March 2001. Guidance for Quality Assurance Project Plans, EPA QA/G-5, EPA/600/R-98/018, February 1998 may be used to help address these requirements. (These documents are available at http://www.epa.gov/quality/)

QAPP requirements for Category III (Applied Research) and Category IV (Basic Research) are presented in this appendix. Guidance for Quality Assurance Project Plans, EPA QA/G-5, EPA/600/R-98/018, February 1998 referenced above may be

used to help address the requirements listed for Category III and IV QAPPs; however, only the requirements listed in this appendix need to be addressed.

QAPP requirements for Sampling and Analysis Projects, Secondary Data Research Projects, Methods Development Projects, and Software and Data Management Projects are also presented in this appendix. Requirements for modeling projects are currently under development. (See your QAM if you need these requirements.)

For projects involving design, construction, and/or operation of environmental technology, the requirements in Part C of ASpecifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology,@ ANSI/ASQC E4-1994, American Society for Quality Control, Milwaukee, WI, January 1995 will be followed.

The requirements for QMPs submitted to NHSRC in response to solicitations are also presented in this appendix.

QAPP REQUIREMENTS FOR PROJECTS USING SECONDARY DATA

A secondary data project involves the gathering and/or use of existing environmental data for purposes other than those for which they were originally collected. These secondary data may be obtained from many sources, including literature, industry surveys, compilations from computerized databases and information systems, and computerized or mathematical models of environmental processes. For these projects, a QAPP shall be prepared to include the requirements identified below. If primary data will also be generated as part of the project, then the information below can be incorporated into the associated QAPP to address the secondary data. The following requirements should be addressed as applicable.

SECTION 1.0, PROJECT OBJECTIVES, ORGANIZATION, AND RESPONSIBILITIES

1.1 The purpose of study shall be clearly stated.

1.2 Project objectives shall be clearly stated.

1.3 The secondary data needed to satisfy the project objectives shall be identified. Requirements relating to the type of data, the age of data, geographical representation, temporal representation, and technological representation, as applicable, shall be specified.

1.4 The planned approach for evaluating project objectives, including formulas, units, definitions of terms, and statistical analysis, if applicable, shall be included.

1.5 Responsibilities of all project participants shall be identified, meaning that key personnel and their organizations shall be identified, along with the designation of responsibilities for planning, coordination, data gathering, data analysis, report preparation, and quality assurance, as applicable.

SECTION 2.0, SOURCES OF SECONDARY DATA

2.1 The source(s) of the secondary data must be specified.

2.2 The rationale for selecting the source(s) identified shall be discussed.

2.3 The sources of the secondary data will be identified in any project deliverable.

SECTION 3.0, QUALITY OF SECONDARY DATA

3.1 Quality requirements of the secondary data must be specified. These requirements must be appropriate for their intended use. Accuracy, precision, representativeness, completeness, and comparability need to be addressed, if applicable. (If appropriate, a related QAPP containing this information can be referenced.)

3.2 The procedures for determining the quality of the secondary data shall be described.

3.3 If no quality requirements exist, this shall be stated in the QAPP. If no quality requirements exist or if the quality of the secondary data will not be evaluated by EPA, the QAPP shall require that a disclaimer be added to any project deliverable to indicate that the quality of the secondary data has not been evaluated by EPA for this specific application. The wording for the disclaimer shall be defined.

SECTION 4.0, DATA REPORTING, DATA REDUCTION, AND DATA VALIDATION

4.1 Data reduction procedures specific to the project shall be described, including calculations and equations.

4.2 The data validation procedures used to ensure the reporting of accurate project data shall be described.

4.3 The expected product document that will be prepared shall be specified (e.g., journal article, final report, etc.).

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-087

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — **Accounting and Appropriations Data** — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Lukas Oudejans	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-2973
			FAX Number:
Project Officer Name: Robin Baily	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-7906
			FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code:
			Phone Number:
			FAX Number:
Contracting Official Name: Mark Cranley	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-487-2351
			FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Technical Support to Underground Transport Restoration Operational Technology Demonstration

ABBREVIATED WA TITLE: Technical Support to UTR OTD

WA #: 1-087 WACOR: Lukas Oudejans

Contract #: EP-C-15-008 Alternate WACOR: Worth Calfee

NHSRC Project Number: HS8.63.02

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

The proposed work will provide technical support to the scheduled operational technology demonstration (OTD), which will be conducted at Fort AP Hill, VA starting on September 19, 2016. This OTD will be led by EPA's National Homeland Security Research Center (NHSRC) and EPA's Consequence Management Advisory Team (CMAT). The technical support includes, but is not limited to, preparation of sampling kits; transportation of equipment to OTD site; modifications to equipment purchased by EPA for use during the OTD; griming of identified building material coupons and ballast; and other technical support activities prior to the OTD. The proposed work does not include actual support during the OTD. Post-OTD activities may include the transport of equipment from the OTD site.

BACKGROUND

The intentional release of *Bacillus anthracis* (*Ba*) or other bio agent in a subway system would have a devastating impact on the local and national economy. Being able to respond to and remediate the subway system is critical to homeland security. Preparing for such an event can reduce the time it takes to return the system to service. The US Environmental Protection Agency (EPA) is collaborating with the Department of Homeland Security (DHS) under their Underground Transport Restoration (UTR) program to execute a full scale OTD in a subway like environment. This OTD has been scheduled to take place at Fort AP Hill, VA over the course of five weeks starting September 19, 2016.

SCOPE

The scope of this work assignment is for the contractor to provide technical support to NHSRC in relation to UTR OTD activities. No environmental data will be generated as part of this work assignment.

The research activities, including quality assurance requirements related to the grimed coupons will be covered under a concurrent work assignment.

TECHNICAL APROACH

The contractor shall anticipate to provide technical support to NHSRC in following (but not limited to) areas identified here as tasks:

Task #	Description
1	Preparation of approximately 2000 sampling kits for biological agent sampling from surfaces present in the subway environment.
2	Construction of crates that will hold ballast material (12" x 12" x 12" dimensions)
3	Application of grime to ballast
4	Application of grime to approximately 40 coupons of 12" x 12" dimensions
5	Transportation of equipment and supplies from US EPA campus, RTP, NC to Fort AP Hill, VA prior to the OTD
6	Transportation of equipment and supplies that will be returned from Fort AP Hill, VA to the US EPA campus in RTP, NC
7	Modifications to purchased fogging and spraying equipment [as needed] (e.g., changes in plumbing; connecting hoses; other revisions)
8	Other support needs related to OTD

Details on each activity will be discussed with the EPA WACOR or ALT WACOR during the course of this work assignment.

WA SPECIFIC EQUIPMENT

No specific equipment has been identified for purchase by the contractor

QUALITY ASSURANCE

This WA will not generate environmental data; only technical support is included in this PWS. Therefore, there is no QA requirement.

DELIVERABLES

The deliverables of this work assignment consist of the preparation of sampling kits; creation of crates to hold ballast material; and griming of coupons and ballast.

SCHEDULE of DELIVERABLES

Task	*Deliverable*	*Schedule*
1	Sampling kits	September 1, 2016
2	Ballast crates	August 1, 2016
3	Grimed Ballast	August 15, 2016
4	Grimed Coupons	August 15, 2016

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-087

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2016
Base Option Period Number 1

Title of Work Assignment/SF Site Name:

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — **Accounting and Appropriations Data** — ☒ Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Lukas Oudejans
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-2973
FAX Number:

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name:
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Amendment I to

Performance Statement of Work

WA Title: Technical Support to Underground Transport Restoration Operational Technology Demonstration

ABBREVIATED WA TITLE: Technical Support to UTR OTD

WA #: 1-087 WACOR: Lukas Oudejans

Contract #: EP-C-15-008 Alternate WACOR: Worth Calfee

NHSRC Project Number: HS8.63.02

JUSTIFICATION FOR AMENDMENT 1:

This amendment adds (XX) additional tasks (highlighted in yellow) to the Technical Approach section. There are no changes to the period of performance, objectives, background, and scope.

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

The proposed work will provide technical support to the scheduled operational technology demonstration (OTD), which will be conducted at Fort AP Hill, VA starting on September 19, 2016. This OTD will be led by EPA's National Homeland Security Research Center (NHSRC) and EPA's Consequence Management Advisory Team (CMAT). The technical support includes, but is not limited to, preparation of sampling kits; transportation of equipment to OTD site; modifications to equipment purchased by EPA for use during the OTD; griming of identified building material coupons and ballast; and other technical support activities prior to the OTD. The proposed work does not include actual support during the OTD. Post-OTD activities may include the transport of equipment from the OTD site.

BACKGROUND

The intentional release of *Bacillus anthracis* (*Ba*) or other bio agent in a subway system would have a devastating impact on the local and national economy. Being able to respond to and remediate the subway system is critical to homeland security. Preparing for such an event can reduce the time it takes to return the system to service. The US Environmental Protection Agency (EPA) is collaborating with the Department of Homeland Security (DHS) under their Underground Transport Restoration (UTR) program

to execute a full scale OTD in a subway like environment. This OTD has been scheduled to take place at Fort AP Hill, VA over the course of five weeks starting September 19, 2016.

SCOPE

The scope of this work assignment is for the contractor to provide technical support to NHSRC in relation to UTR OTD activities. No environmental data will be generated as part of this work assignment. The research activities, including quality assurance requirements related to the grimed coupons will be covered under a concurrent work assignment.

TECHNICAL APROACH

The contractor shall anticipate to provide technical support to NHSRC in following (but not limited to) areas identified here as tasks:

Task #	Description
1	Preparation of approximately 2000 sampling kits for biological agent sampling from surfaces present in the subway environment.
2	Construction of crates that will hold ballast material (12" x 12" x 12" dimensions)
3	Application of grime to ballast
4	Application of grime to approximately 40 coupons of 12" x 12" dimensions
5	Transportation of equipment and supplies from US EPA campus, RTP, NC to Fort AP Hill, VA prior to the OTD
6	Transportation of equipment and supplies that will be returned from Fort AP Hill, VA to the US EPA campus in RTP, NC
7	Modifications to purchased fogging and spraying equipment [as needed] (e.g., changes in plumbing; connecting hoses; other revisions)
8	Acquisition of ATI chlorine sensors (4) and data acquisition system; verification of functionality and data collection on laptop
9	Acquisition of backpack sprayers (5); testing of functionality using water
10	Travel* to Fort AP Hill for inoculation of approx. 60 14"x14" coupons on September 27, 2016.
11	Support to waste management practices as developed under different onsite contract
12	Other support needs related to OTD including sterilization of misc. equipment or coupons

*: Including equipment for inoculation: ADAs [60], MDIs [number TBD], balance, etc.

Details on each activity will be discussed with the EPA WACOR or ALT WACOR during the course of this work assignment.

WA SPECIFIC EQUIPMENT

Specific equipment as identified for purchase by the contractor consists of:

- Four (4) ATI chlorine sensors for use during OTD

- One (1) PDAQ data acquisition system in support of ATI chlorine sensors
- Five (5) backpack type sprayers identical to existing units in DTRL for use during OTD

QUALITY ASSURANCE

This WA will not generate environmental data; only technical support is included in this PWS. Therefore, there is no QA requirement.

DELIVERABLES

The deliverables of this work assignment consist of the preparation of sampling kits; creation of crates to hold ballast material; generation of artificial grime as per Sandia National Lab formulation grime; and griming of coupons and ballast. All technical support tasks are for support to the scheduled UTR-OTD which starts on September 12, 2016. Most identified tasks require completion in advance of this start date. Three tasks (#5, #6, and #10) have critical dates for execution.

SCHEDULE of DELIVERABLES

Task	*Deliverable*	*Schedule*
1	Sampling kits	August 1, 2016
2	Ballast crates	August 1, 2016
3	Grimed Ballast	August 15, 2016
4	Grimed Coupons	August 15, 2016
5	Transport equipment to Fort AP Hill	September 12, 2016
6	Transport equipment from Fort AP Hill	No later than October 14, 2016
7	Modifications to spray and fogging equipment	August 15, 2016
8,9	Completed shakedown of ATI sensors, PDAQ system, and backpack sprayers	July 15, 2016
10	Inoculated coupons at Fort AP Hill	September 27, 2016
11&12	Completed support functions	September 2, 2016

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-088

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008	Contract Period 04/01/2015 To 03/31/2017 Base X Option Period Number	Title of Work Assignment/SF Site Name: 1-088
Contractor: JACOBS TECHNOLOGY INC.	Specify Section and paragraph of Contract SOW: 1, 2, 6	

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — **Accounting and Appropriations Data** — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Sangdon Lee (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-4531 FAX Number:	
Project Officer Name: Robin Baily (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:	
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:	
Contracting Official Name: Mark Cranley (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109	

PERFORMANCE WORK STATEMENT

Impact of Methyl Bromide and Methyl Iodide Fumigations on Electronic Equipment

PROJECT# HS 8.63

WORK ASSIGNMENT 1-088

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HOMELAND SECURITY RESEARCH CENTER
DECONTAMINATION AND CONSEQUENCE MANAGEMENT DIVISION

I. PERIOD OF PERFORMANCE 2
II. SUMMARY OF OBJECTIVES 2
III. RELEVANCE 2
IV. BACKGROUND ..... 3~~3~~
V. SCOPE ..... 3~~3~~
VI. TECHNICAL APPROACH ..... 3~~3~~
VII. FACILITIES AND MATERIALS ..... 3~~3~~
VIII. TASKS ..... 4~~4~~
IX. DELIVERABLE SCHEDULE ..... 4~~4~~
X. RESPONSIBILITIES ..... 5~~5~~

TITLE

Impact of Methyl Bromide and Methyl Iodide Fumigations on Electronic Equipment

I. PERIOD OF PERFORMANCE

The period of performance for the work under this work assignment shall be April 1, 2016 through March 31, 2017.

II. SUMMARY OF OBJECTIVES

The main purpose of this work is to provide information to decision makers about the potential material-impact on electronic equipment of fumigation (without chloropicrin) using MeBr or MeI under conditions expected to inactivate *B. anthracis*. This study will evaluate the impacts on physical appearance and functionality of desktop computers representing sensitive electronic equipment that might be fumigated in the field. As a supplementary evaluation, this study will also assess the physical impact of fumigation on coupons of electronic-relevant metals. Since it may not be possible or convenient to power-off electronic equipment in the field, an additional purpose is to determine whether the power-state (on/off) of the desktop computers affects material compatibility or the effectiveness of the fumigation to inactivate surrogate spores located inside the computer.

Conditions critical to fumigation efficacy, particularly relative humidity, may be different inside an operating computer than in the surrounding space; in our previous study using less aggressive conditions surrogate spores were not completely inactivated inside fumigated computers (USEPA 2012).

The results of this study will inform decisions about the application of methyl bromide and methyl iodide fumigants in field conditions requiring the inactivation of B. anthracis spores near or inside electronic equipment similar in operation to desktop computers.

III. RELEVANCE

This project supports the mission of the Decontamination and Consequence Management Division (DCMD) within the U.S. Environmental Protection Agency's (U.S. EPA) National Homeland Security Research Center (NHSRC) by providing relevant information pertinent to the decontamination of contaminated areas resulting from an act of terrorism. The project supports the EPA's Homeland Security Research Program (HSRP) and the NHSRC's strategic goals as described in detail in the Homeland Security Research Multi-year Strategic Plan (draft, November 26, 2008). Specifically, the project is relevant to Long-Term Goal 2 (LTG-2) which states, "The Office of Land and Emergency Management (OLEM) and other clients use homeland security research program products and expertise to improve the capability to respond to terrorist attacks affecting buildings and the outdoor environments." This project addresses a direct need expressed by OLEM's CBRN Consequence Management Advisory Division (CMAD), regarding an understanding of fumigant impact on materials for a wide area anthrax incident. Due to the potential relevance of this project in preparing for the Federal response to wide-area anthrax incidents, this project will be managed by NHSRC with the support of a multidisciplinary project team.

IV. BACKGROUND

Building decontamination following the release of a bio-threat agent such as *Bacillus anthracis* can be performed using different decontamination techniques, e.g., fumigation of the building with chlorine dioxide, vaporous hydrogen peroxide, or methyl bromide. Unlike hydrogen peroxide and chlorine dioxide, methyl bromide (MeBr) is not an oxidizing agent and is much less reactive. In our previous evaluation of MeBr fumigation compatibility with materials and electronics we used a mixture of 98% MeBr and 2% chloropicrin. The chloropicrin, added as a warning agent, was implicated in most of the observed damage to materials and electronics (LGS Innovations LLC 2010, USEPA 2012). In this project we will evaluate the impact of MeBr fumigation without chloropicrin on electronic equipment under conditions expected inactivate B. anthracis on a variety of surfaces (USEPA 2014b). We will also evaluate the impact of methyl iodide (MeI), a fumigant having similar efficacy (USEPA 2014a) but unlike MeBr, not subject to the Montreal Protocol On Substances That Deplete the Ozone Layer (Sutton et al. 2015). The results of this compatibility testing will inform application of these fumigants in the field and suggest areas of further laboratory research.

V. SCOPE

The selected materials and equipment will be exposed to the controlled MeBr and MeI fumigation. The fumigated materials and equipment will be evaluated for their functionality and chemical/physical changes. The fumigant concentration, relative humidity, and temperature will be maintained at the preselected level throughout the fumigation. Biological indicators will be used to determine the effectiveness of spore inactivation by fumigants. All test parameters, such as test chamber size, material types and sizes, assessment methods, methods of analysis will be determined by agreement among participating experts mentioned previously.

VI. TECHNICAL APPROACH

The effects of the fumigation on desktop computers will be investigated for their functionality. As a supplementary evaluation the impact of fumigation on metal coupons will be assessed for visual damage and corrosion. All visual inspections will be documented in writing and using digital photographs. Functionality testing will be documented in writing, through software-generated reports, and by digital photography, where appropriate. Three different conditions will be evaluated: fumigation with methyl bromide, fumigation with methyl iodide, and a control condition at the same temperature and relative humidity (RH) but without fumigant.

VII. FACILITIES AND MATERIALS

All tasks described in this PWS shall be performed for BI analysis, material and electronic equipment assessment in-house at the EPA's Research Triangle Park (RTP) facilities at 109 T.W. Alexander Dr. MeBr and MeI fumigation shall be performed at the Contractor identified laboratory with the approval from the EPA WACOR. The test material preparation and assessment activities shall be conducted in the NHSRC's Decontamination Technologies Research Lab (DTRL) located in H-224, H-222, H-122a, and H-130a. The lab contains the necessary equipment for the tasks described herein. The analysis of the biological samples shall be conducted in the Microbiology lab, located in E-386, E-388, and E-390.

VIII. TASKS

The contractor shall provide the personnel, equipment, materials, and supplies necessary to perform the following Work Assignment for the study of Impact of Methyl Bromide and Methyl Iodide Fumigations on Electronic Equipment. Material procurement and test conditions shall be discussed with the EPA WACOR prior to the QAPP development.

Task 1. QAPP Development

The contractor shall prepare a QAPP in accordance with Quality Assurance (QA) Category_B_. Attachment 1 to the PWS provides information regarding NHSRC QA Requirements/Definitions List.

QAPPs being developed for Category A (formerly Category 1 or 2) projects must be developed in accordance with the document titled "EPA Requirements for Quality Assurance Project Plans." EPA QA/R-5 can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf. At the discretion of the COR, a Category B (formerly category 3) QAPP can be developed based on the R5 guidance or a project-specific QA requirements provided on the NHSRC@work website.

The QAPP must be approved prior to the start of any literature searches (existing data), data collection, gathering, synthesizing, or data generation (laboratory) work. Additional information related to QA requirements can be found at www.epa.gov/quality.

Task 2. Material Procurement

The Contractor shall purchase the necessary materials and equipment for fumigation exposure tests. The items include desktop computers, keyboards, mouse, software, fumigation chamber, electric cables, biological indicators, computer cables, DVD drives, etc. The contractor shall check the purchased items for any defects or malfunctions. All purchase items shall be consulted with EPA WACOR before procurement.

Task 3. Fumigation Test

The Contractor shall conduct a market research to identify the laboratory that can perform the fumigation tests with the conditions identified in the QAPP from Task 1. The selected fumigation laboratory shall be disclosed to EPA WACOR before testing. The Contractor shall conduct the fumigation tests according to the procedures in the QAPP. The Contractor shall demonstrate that the test chamber conditions (e.g. MeBr/MeI concentrations, relative humidity and temperature) are met according to the QAPP before the material exposure. The Contractor shall monitor the critical parameters, such as fumigant concentration, relative humidity, temperature, fumigation duration, etc, throughout the fumigation. The Contractor shall properly transfer the test materials between the EPA facility and the fumigation laboratory. EPA will analyze the electronic and coupon items following the QAPP. The contractor shall analyze the BIs for log reduction following fumigation.

IX. DELIVERABLE SCHEDULE

QAPP

A draft QAPP and Work Plan shall be provided within 30 days of the award of this agreement. This shall be provided prior to commencement of the tests described within this PWS. The

QAPP and Work Plan shall include scope, scheduling, and costing information for each of the tests planned.

Reporting
A fumigation laboratory shall be selected and disclosed to EPA for review within 30 days of the award of this agreement. All measurement records and electronic documents shall be delivered to the EPA WACOR by March 31st 2017.

X. RESPONSIBILITIES

This project is initiated by the USEPA Office of Research and Development, National Homeland Security Research Center (NHSRC), Decontamination and Consequence Management Division (DCMD) in Research Triangle Park, NC. The U.S. EPA WACOR shall be Dr. Sang Don Lee (phone 919-541-4531, email lee.sangdon@epa.gov). Shannon Serre shall be the alternate WACOR.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-089

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

Accounting and Appropriations Data

☐ Superfund ☒ Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2)

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Joe Wood
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-5029
FAX Number: 919-541-0496

Project Officer Name Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Evaluation of Street Sweepers for Spore Removal
Performance Work Statement

Project# HS8.62.01 - 320
Work Assignment 1-089
(APPCD ON-SITE CONTRACT EP-C-15-008)

I. TITLE: Evaluation of Street Sweepers for Spore Removal

II. PERIOD OF PERFORMANCE

The period of performance for this work assignment shall be from the April 1, 2016 – March 31, 2017.

III. SUMMARY OF OBJECTIVES

The contractor shall provide support in conducting market research on street sweepers, including a walk-behind industrial type street sweeper that would be used in experiments. Based in this research, the contractor shall purchase a street sweeper. Experiments will then be conducted to evaluate how well the sweeper removes and collects bacterial spores and other similar sized particles such as fluorescent microspheres. Surface and air samples of spores will be collected and analyzed. If the sweeper utilizes water or other liquid for dust suppression, samples of this water or liquid may also be collected. A report of the study will be produced.

IV. RELEVANCE

The results of the work conducted under this WA study will provide data and information on the efficacy of this type of technology in removing bacterial spores from floors and streets. The results of this work will be made available through a published report, and possibly a conference abstract and presentation.

V. BACKGROUND

Following a bioterrorist attack, materials contaminated with a biological agent such as *Bacillus anthracis* spores pose significant health threats. The EPA's NHSRC conducts research to develop methods and technologies able to rapidly and cost-effectively remediate areas affected by a bioterrorism attack. Tasks performed under this work assignment support such research.

VI. TECHNICAL APPROACH

The work will first involve conducting market research on street sweepers in general, and walk-behind industrial type street sweepers in particular. Based on this research, and in consultation with the work assignment manager (WAM), the contractor shall purchase a walk behind street sweeper to be used for evaluation. Experiments will then be conducted to evaluate how well the sweeper removes and collects bacterial spores and other similar sized particles (e.g., fluorescent polystyrene latex spheres) from surfaces. The testing will also quantify aerosolization of spores or spheres. It is expected that the tests will be conducted within some type of enclosure to facilitate collection of aerosolized particles. If the sweeper utilizes water or other liquid for dust suppression, samples of this water or liquid may also be collected for analysis. A report of the study will be produced.

VII. FACILITIES AND MATERIALS

All tasks described in this PWS shall be performed in-house, at the EPA's Research Triangle Park (RTP) facilities. Experiments of the street sweeper may be performed at the EPA's Page Road facility or possibly within one of the storage sheds on shed row.

VIII. TASKS

The contactor shall perform the following tasks:

Task 1. Preparation of the Quality Assurance Project Plan (QAPP).
The Contractor shall prepare a QAPP in accordance with Quality Assurance (QA) Category B. Attachment 1 to the Performance Work Statement (PWS) provides information regarding NHSRC QA Requirements/Definitions List. QAPPs prepared for a Category B (formerly known as a Category 3 or 4) project must be developed in accordance with the document titled "EPA Requirements for Quality Assurance Project Plans." EPA QA/R-5 can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf and must be approved by an EPA Quality Assurance Manager (QAM) prior to the start of any literature searches (existing data), data collection, gathering, synthesizing, or data generation (laboratory) work. At the discretion of the Contract Officer Representative (COR), a Category B QAPP may be based on the R5 guidance (described above) or a NHSRC project-specific QA requirements template provided as Attachment 2. Additional information related to QA requirements can be found at www.epa.gov/quality.

Task 2. Conduct market research
The contractor shall conduct research on the availability, technical aspects, and costs of walk-behind street sweepers. Similar technical background information on full size street sweepers shall also be collected. This research will be used to aid in the selection of a walk behind street sweeper that will be purchased under Task 3 and used in experiments under Task 4. The contractor shall deliver a spreadsheet which shall include information such as (but not limited to) company, model number, cost, description of technology, expected efficacy for removal of micron sized particles, use of a high efficiency particle arrestor (HEPA) filter, etc. It is expected that research will involve the use of the World Wide Web as well as communications with vendors via email and phone calls.

Task 3. Purchase walk-behind street sweeper
In consultation with the WAM, the contractor shall purchase a street sweeper based on the analysis conducted in Task 2. It is expected that the cost of the sweeper shall be no more than $10,000.

Task 4. Conduct experiments with the street sweeper
The contractor shall conduct testing according to the QAPP developed under Task 1 and per the following requirements:

A. Microbiological and related methods (e.g., spore preparation, sterilization and preparation of coupons, numbers of replicates and blanks, inoculation of spores onto coupons, recovery and quantitation of spores from coupons, characterization of efficacy, air and water sample collection and analysis, etc.) conducted under this WA shall be documented in the QAPP, and shall be consistent with previous work conducted under this contract. Quality control/quality assurance procedures for all microbiological related analyses and measurements shall be documented in the QAPP. All work conducted in the bio-contaminant laboratory for this sub-task shall be charged to WA 1-061 of this contract.

B. Conduct preliminary tests to develop and assess feasibility and appropriateness of methods for the use of fluorescent microspheres. This subtask shall evaluate methods for the inoculation, dissemination, containment, and measurement of fluorescent spheres on surfaces and in air relative to the use of a street sweeper. If the sweeper utilizes water or other liquid for dust suppression, samples of this water may also be collected for analysis. This subtask will also include the development of an enclosure to contain the microspheres and facilitate the collection of air samples.

C. Conduct preliminary tests to develop and assess feasibility and appropriateness of methods for the use of bacterial spores such as *Bacillus atrophaeus*. This subtask shall evaluate methods for the inoculation, dissemination, containment, and measurement of spores on surfaces and in air relative to the use of a street sweeper. If the sweeper utilizes water or other liquid for dust suppression, samples of this water may also be collected for analysis.

D. Conduct 10 experiments to quantify the removal and capture of spores and/or microspheres from simulated street surfaces, and the generation of spore or microsphere aerosols. These experiments shall use methods developed under subtasks A-C of this Task 4, and also in concert with the QAPP developed under Task 1. Initial test conditions shall be selected in consultation with the WAM during the writing of the QAPP, and follow-on test conditions shall be selected based on results of ongoing tests. That is, in consultation with the WAM, the test matrix will be adjusted as testing proceeds. Experimental variables may include, but are not limited to, the use of spores versus microspheres; type of pavement surface, use of water or sporicidal liquid (if dust suppression is used), area vacuumed, rate of vacuuming, etc.

Task 5. Provide general support for maintaining the lab equipment.
This support shall include assembly, maintenance, troubleshooting, and configuration support for the any equipment used for testing. Support shall also include the purchase of any expendable materials, with prior approval from the WAM, for use in this project.

Task 6. Report the results of all tests to the WAM as soon as possible.
Report the results of each test to the WAM within 7 days, via email and through the use of the DTRL share drive. The WAM shall be notified immediately of any problems encountered in the laboratory or with the results obtained. These data shall include data from biolab, any generated data files (i.e., logged data) properly annotated, reports of the experimental conditions, calibration checks, measured variables, and a listing of the samples awaiting further analysis.

Task 7. Analyze the data
Analyze the data per the requirements in the QAPP and in consultation with the WAM, report the results of these analyses within seven days via email and through the use of the DTRL share drive. The expected data analyses would be in the form of Excel spreadsheets or other appropriate software.

Task 8. Meet with the WAM
Meet with the WAM at least every week to provide a project status update. The update shall include a synopsis of activities taking place the past week, problems encountered, and work planned for the next week.

Task 9. Update the health and safety protocols.
Update the health and safety research protocols, as needed, as required by the EPA Facility and APPCD safety personnel. Updates to these protocols shall be approved by the EPA WAM and safety personnel prior to the commencement of any testing. The contractor shall provide a copy of the health and safety plan to the WAM and the ORD-Safety Office for discussion.

Task 10. Prepare monthly reports
Prepare monthly reports to EPA that summarize work activities (accomplished and planned) in this work assignment, including the status of applicable test, QA, and safety plans. The monthly report shall also detail labor costs and ODC charges. The ODC charges shall be documented in the report in a way that the items purchased, vendor, and cost are clearly indicated.

Task 11. Prepare test report
Prepare a draft test report, and based on comments received from WAM, revise report to produce a final test report. The scope of the report shall be similar to previous EPA published reports. See, for example, U.S. EPA Report 600/R-14/208, titled "Decontamination of a Mock Office Using Chlorine Dioxide Gas".

IX. MILESTONES, DELIVERABLES, AND COMPLETION DATES

Data Delivery
Raw data from the biolab (e.g., plate counts, qualitative growth results, etc.) shall be emailed to the WAM, and by carbon copy (cc) to the WAM of the project the microbiology lab is supporting, as soon as the data become available (not greater than 2 working days after completion of the analysis generating the data).

Reporting
The Contractor shall provide written monthly status reports using an MS WORD format to the EPA Biocontaminant lab WAM. The reports shall be prepared specifying the following: (1) summary of work conducted during the preceding months, including tables and/or charts using MS EXCEL format, as appropriate, with sufficient annotation as deemed adequate by the EPA WAMs, (2) analyses of the work in accordance to the expectations specified by the QAPP of each project, (3) progress on each task and the reason for any deviations from the project schedule, (4) work anticipated during the coming quarter. These reports shall be submitted electronically near the end of each quarter. Additionally, pdf copies of the laboratory notebook, including the pages documenting activities performed during the period, shall be created and delivered electronically to the WAM the same day the quarterly report is delivered.

Deliverable schedule
The following table outlines the expected schedule that the contractor shall meet for the period covered by this SOW. The schedule assumes a start date of April 1, 2016. Dates dependent upon completion of specific tasks shall be updated based on discussions between the contractor WAL and EPA WAM during the development of the test plans to cover the work specified herein.

Suggested Deliverable Schedule

Deliverable	Completion Date
Submit work assignment plan	4/15/16
Submit first draft of test/QA Plan	5/15/16
Revise QA Plan per WAM comments	2 weeks after comments received
Submit Task 2 spreadsheet tabulating/summarizing street sweeper technical information and results from market research	6/15/16
Purchase walk behind street sweeper	8/15/16
Complete Task 4, subtasks B and C (method development tests)	11/15/16
Complete Task 4, subtask D (10 experiments)	2/15/17
Submit draft test report (Task 11)	3/1/17
Submit final report (Task 11)	3/30/17

X. RESPONSIBILITIES

This WA will be managed by the USEPA Office of Research and Development, National Homeland Security Research Center (NHSRC), Decontamination and Consequence Management Division (DCMD) in Research Triangle Park, NC. The Work Assignment Contractor Officer Representative will be Joseph Wood (phone 919-541-5029, email wood.joe@epa.gov).

Attachment 1 to the Statement of Work or Performance Work Statement

NHSRC QA Requirements/Definitions List

EPA's Quality System Website: http://www.epa.gov/quality

In accordance with EPA CIO 2105.0 (Order), EPA 2105-P-01-0 (Manual), and conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation described herein. All Quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approve the quality documentation. The Quality Assurance Project Plan (QAPP) shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government.

NHSRC's Quality System Specifications for Extramural Actions –

These requirements typically pertain to single project efforts. The five specifications are:

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

NHSRC QA Requirements/Definitions List

Category Level Designations (determines the level of QA required):

☐ **Category A Project (formerly Category 1 and 2)** – applies to research that is anticipated to result in high-visibility products. In this case, the QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5. http://www.epa.gov/quality/qs-docs/r5-final.pdf

Research of this nature meets one or more of the following criteria:

- Results are ISI
- Has a high probability the results could be used in litigation or enforcement
- Is a HISA
- Direct regulatory support

☐ **Category B Project (formerly Category 3 and 4)** - applicable to projects that do not meet the criteria for Category A. In lieu of using "EPA Requirements for QA Project Plans, EPA QA/R-5, a QAPP may be develo0ped in accordance with NHSRC's QAPP requirement templates. This decision is made by the Principal Investigator or lead researcher.

Additional information regarding QAPP requirements for a specific project type are provided below.

Project Types:

NHSRC's QAPP Requirements templates are available for Applied Research Projects, Sampling and analysis Project, Method Development Project, and Existing Data Project. These templates are condensed from applicable sections of R-5 (EPA Requirements for QA Project Plans) and are intended to serve as a starting point when preparing a QAPP. These templates and their format may not fit every research scenario and QAPP's must conform to applicable sections of R-5 in a way that fully describes the research plan and appropriate QA and QC measures to ensure that the data are of adequate quality and quantity to fit their intended purpose.

Note: the template should be provided as Attachment 2 to the SOW or PWS.

☐ **Applied Research Project** - pertains to a study performed to generate data to demonstrate the performance of accepted processes or technologies under defined conditions. These studies are often pilot- or field-scale.

☐ **Sampling and Analysis Project** - pertains to the collection and analysis of samples with no objectives other than to provide characterization or monitoring information.

☐ **Existing Data Project** - pertains to environmental data collected from other sources, by or for EPA, that are used for purposes other than those originally intended. Sources may include: literature, industry surveys, compilations from computerized databases and information systems, and computerized or mathematical models of environmental processes.

☐ **Method Development Project** - pertains to situations where there is no existing standard method, or a standard method needs to be significantly modified for a specific application.

For other types of project types, the EPA Guidance documents are available. All QAPPs must conform to applicable sections of R-5 in a way that fully describes the research plan and appropriate QA and QC measures to

ensure that the data are of adequate quality and quantity to fit their intended purpose. The specific and general guidance documents can be found at http://www.epa.gov/quality/qa_docs.html#guidance

☐ **Design, Construction, and/or Operation of Environmental Technology Project** - pertains to environmental technology designed, constructed and/or operated by and/or for EPA. The QAPP shall address requirements in the EPA Quality System document "Guidance on Quality Assurance for Environmental Technology Design, Construction, and Operation" (EPA QA/G-11)

☐ **Geospatial Data Quality Assurance Project** - pertains to data collection; data processing and analysis; and data validation of geospatial applications. The QAPP shall address requirements in the EPA Quality System document "Guidance for Geospatial Data Quality Assurance Project Plans" EPA QA /G-5S).

☐ **Model Development Project** - includes all types of mathematical models including static, dynamic, deterministic, stochastic, mechanistic, empirical, etc. The QAPP shall address requirements in the EPA Quality System document "Guidance for Quality Assurance Project Plans for Modeling" (EPA QA/G-5M)

Definitions:

Environmental Data - These are any measurement or information that describe environmental processes, location, or conditions; ecological or health effects directly from measurements, produced from software and models, and compiled from other sources such as data bases or the literature. For EPA, environmental data include information collected directly from measurements, produced from software and models, and compiled from other sources such as data bases or literature.

Incremental Funding - Incremental funding is partial funding, no new work.

Quality Assurance (QA) - Quality assurance is a system of management activities to ensure that a process, item, or service is of the type and quality needed by the customer. It deals with setting policy and running an administrative system of management controls that cover planning, implementation, and review of data collection activities and the use of data in decision making. Quality assurance is just one part of a quality system.

Quality Assurance Project Plan (QAPP) - A QAPP is a document that describes the necessary quality assurance, quality control, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. A QAPP documents project-specific information.

Quality Control (QC) - Quality control is a technical function that includes all the scientific precautions, such as calibrations and duplications, which are needed to acquire data of known and adequate quality.

Quality Management Plan (QMP) - A QMP is a document that describes an organization's/program's quality system in terms of the organizational structure, policy and procedures, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, documenting, and assessing all activities conducted. A QMP documents the overall organization/program, and is primarily applicable to multi-year, multi-project efforts. An organization's/program's QMP shall address all elements listed in the "Requirements for Quality Management Plans" in Appendix B of the NHSRC QMP.

Quality System - A quality system is the means by which an organization manages its quality aspects in a systematic, organized manner and provides a framework for planning, implementing, and assessing work performed by an organization and for carrying out required quality assurance and quality control activities.

R-2. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001
http://www.epa.gov/quality/qs-docs/r2-final.pdf

R-5. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001
http://www.epa.gov/quality/qs-docs/r5-final.pdf

Substantive Change - Substantive change is any change in an activity that may alter the quality of data being used, generated, or gathered.

Principal Investigator (PI) - This person is technically responsible for the project. For extramural contract work, the PI is typically the contracting officer's representative (COR). For intramural work, the lead researcher is typically the Principal Investigator.

Abbreviations:

COR	Contracting Officer's Representative
NHSRC	National Homeland Security Research Center
QA ID	Quality Assurance Identification
QAPP	Quality Assurance Project Plan
QS	Quality System
PI	Principal Investigator

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-090

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base Option Period Number 1	1-090

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Lukas Oudejans (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-2973 FAX Number:	
Project Officer Name Robin Baily (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:	
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:	
Contracting Official Name Mark Cranley (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109	

To the Statement of Work
NHSRC QA Requirements/Definitions List

EPA=s Quality System Website: http://www.epa.gov/quality

EPA's Requirements and Guidance Documents: http://www.epa.gov/quality/qa_docs.html

EPA's Quality System Website: http://www.epa.gov/quality/qs-docs/r5-final.pdf

In accordance with EPA CIO 2105.0 (Order), EPA 2105-P-01-0 (Manual), and conformance to ANSI/ASQC E4 must be demonstrated by submitting the quality documentation described herein. All Quality documentation shall be submitted to the Government for review. The Government will review and return the quality documentation, with comments, and indicate approval or disapproval. If the quality documentation is not approved, it must be revised to address all comments and shall be resubmitted to the Government for approval. Work involving environmental data collection, generation, use, or reporting shall not commence until the Government has approve the quality documentation. The Quality Assurance Project Plan (QAPP) shall be submitted to the Government at least thirty (30) days prior to the beginning of any environmental data gathering or generation activity in order to allow sufficient time for review and revisions to be completed. After the Government has approved the quality documentation, the Contractor shall also implement it as written and approved by the Government.

NHSRC's Quality System Specifications for Extramural Actions –

These requirements typically pertain to single project efforts. The five specifications are:

(1) a description of the organization's Quality System (QS) and information regarding how this QS is documented, communicated and implemented;

(2) an organizational chart showing the position of the QA function;

(3) delineation of the authority and responsibilities of the QA function;

(4) the background and experience of the QA personnel who will be assigned to the project; and

(5) the organization's general approach for accomplishing the QA specifications in the SOW.

NHSRC QA Requirements/Definitions List

Category Level Designations (determines the level of QA required):

- ☐ **Category 1 Project** - applicable to studies performed to generate data used for enforcement activities, litigation, or research project involving human subjects. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

- ☐ **Category II Project** - applicable to studies performed to generate data used in support of the development of environmental regulations or standards. The QAPP shall address all elements listed in "EPA Requirements for QA Project Plans, EPA QA/R-5.

- ☐ **Category III Project** - applicable to projects involving applied research or technology evaluations. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP: QAPP** requirements for the specific project type (see below).

- ☐ **Category IV Project** - applicable to projects involving basic research or preliminary data gathering activities. The QAPP shall address the applicable sections of "EPA Requirements for QA Project Plans, EPA QA/R-5 as outlined in the **NHSRC's QMP. QAPP** requirements for the specific project type (see below).

Project Types:

These outlines of NHSRC's QAPP Requirements for various project types, from Appendix B of the NHSRC QMP (except where otherwise noted), are condensed from typically applicable sections of R-5 (EPA Requirements for QA Project Plans) and are intended to serve as a starting point when preparing a QAPP. These lists and their format may not fit every research scenario and QAPP's must conform to applicable sections of R-5 in a way that fully describes the research plan and appropriate QA and QC measures to ensure that the data are of adequate quality and quantity to fit their intended purpose.

- ☐ **Applied Research Project** - pertains to a study performed to generate data to demonstrate the performance of accepted processes or technologies under defined conditions. These studies are often pilot- or field-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Applied Research Projects" from Appendix B of the NHSRC QMP.

- ☐ **Basic Research Project** - pertains to a study performed to generate data used to evaluate unproven theories, processes, or technologies. These studies are often bench-scale. The QAPP shall address all requirements listed in "QAPP Requirements for Basic Research Projects" from Appendix B of the NHSRC QMP.

- ☐ **Design, Construction, and/or Operation of Environmental Technology Project** - pertains to environmental technology designed, constructed and/or operated by and/or for EPA. The QAPP shall address requirements in the EPA Quality System document "Guidance on Quality Assurance for Environmental Technology Design, Construction, and Operation" G-11, at http://www.epa.gov/quality/QS-docs/g11-final-05.pdf. For additional information, you may refer to Part C of "Specifications and Guidelines for Quality Systems for Environmental Data Collection and Environmental Technology," ANSI/ASQC E4-1994, American Society for Quality Control, Milwaukee, WI, January 1995.

- ☐ **Geospatial Data Quality Assurance Project** - pertains to data collection; data processing and analysis; and data validation of geospatial applications. The QAPP shall address requirements in the EPA Quality System document "Guidance for Geospatial Data Quality Assurance Project Plans" G-5S at http://www.epa.gov/quality/QS-docs/g5g-final-05.pdf.

- ☐ **Method Development Project** - pertains to situations where there is no existing standard method, or a standard method needs to be significantly modified for a specific application. The QAPP shall address all requirements listed in "QAPP Requirements for Method Development Projects" from Appendix B of the NHSRC QMP.

- ☐ **Model Development Project** - includes all types of mathematical models including static, dynamic, deterministic, stochastic, mechanistic, empirical, etc. The QAPP shall address requirements in the EPA Quality System document "Guidance for Quality Assurance Project Plans for Modeling" G-5M at http://www.epa.gov/quality/QS-docs/g5m-final.pdf.

- ☐ **Sampling and Analysis Project** - pertains to the collection and analysis of samples with no objectives other than to provide characterization or monitoring information. The QAPP shall address all requirements listed in "QAPP Requirements for Sampling and Analysis Projects" from Appendix B of the NHSRC QMP.

- ☐ **Secondary Data Project** - pertains to environmental data collected from other sources, by or for EPA, that are used for purposes other than those originally intended. Sources may include: literature, industry surveys, compilations from computerized databases and information systems, and computerized or mathematical models of environmental processes. The QAPP shall address all requirements listed in "QAPP Requirements for Secondary Data Projects" from Appendix B of the NHSRC QMP.

- ☐ **Software Development and Data Management Project** - pertains to software development, software/hardware systems development, database design and maintenance, data validation and verification systems. The QAPP shall address all requirements listed in "QAPP Requirements for Software Development Projects" from Appendix B of the NHSRC QMP.

Definitions:

Environmental Data - These are any measurement or information that describe environmental processes, location, or conditions; ecological or health effects directly from measurements, produced from software and models, and compiled from other sources such as data bases or the literature. For EPA, environmental data include information collected directly from measurements, produced from software and models, and compiled from other sources such as data bases or literature.

Incremental Funding - Incremental funding is partial funding, no new work.

Quality Assurance (QA) - Quality assurance is a system of management activities to ensure that a process, item, or service is of the type and quality needed by the customer. It deals with setting policy and running an administrative system of management controls that cover planning, implementation, and review of data collection activities and the use of data in decision making. Quality assurance is just one part of a quality system.

Quality Assurance Project Plan (QAPP) - A QAPP is a document that describes the necessary quality assurance, quality control, and other technical activities that must be implemented to ensure that the results of the work performed will satisfy the stated performance criteria. A QAPP documents project-specific information.

Quality Control (QC) - Quality control is a technical function that includes all the scientific precautions, such as calibrations and duplications, which are needed to acquire data of known and adequate quality.

Quality Management Plan (QMP) - A QMP is a document that describes an organization's/program's quality system in terms of the organizational structure, policy and procedures, functional responsibilities of management and staff, lines of authority, and required interfaces for those planning, implementing, documenting, and assessing all activities conducted. A QMP documents the overall organization/program, and is primarily applicable to multi-year, multi-project efforts. An organization's/program's QMP shall address all elements listed in the "Requirements for Quality Management Plans" in Appendix B of the NHSRC QMP.

Quality System - A quality system is the means by which an organization manages its quality aspects in a systematic, organized manner and provides a framework for planning, implementing, and assessing work performed by an organization and for carrying out required quality assurance and quality control activities.

R-2. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001
http://www.epa.gov/quality/QS-docs/r2-final.pdf.

R-5. EPA Requirements for Quality Management Plans (EPA/240/B-01/002) March, 2001
http://www.epa.gov/quality/QS-docs/r5-final.pdf.

Substantive Change - Substantive change is any change in an activity that may alter the quality of data being used, generated, or gathered.

Technical Lead Person (TLP) - This person is technically responsible for the project. For extramural contract work, the TLP is typically the contracting officer's representative (COR). For intramural work, the TLP is typically the Principal Investigator.

Abbreviations:

COR	Contracting Officer's Representative
NHSRC	National Homeland Security Research Center
NRMRL	National Risk Management Research Laboratory
QA ID	Quality Assurance Identification
QAPP	Quality Assurance Project Plan
QS	Quality System
TLP	Technical Lead Person
IAG	Interagency Agreement
QA	Quality Assurance
QAM	Quality Assurance Manager
QMP	Quality Management Plan
SOW	Statement of Work
CRADA	Cooperative Research & Development Agreement

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-091

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base Option Period Number 1

Title of Work Assignment/SF Site Name:

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee — LOE:

Cumulative Approved: — Cost/Fee — LOE:

Work Assignment Manager Name: John Archer
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-1151
FAX Number:

Project Officer Name: Robin S. Harris
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0955
FAX Number:

Other Agency Official Name:
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

PERFORMANCE WORK STATEMENT

DECONTAMINATION LINE PROTOCOL EVALUATION FOR BIOLOGICAL CONTAMINATION INCIDENTS USING ELECTROSTATIC SPRAY

HS8.62.01-1123

U.S. ENVIRONMENTAL PROTECTION AGENCY
NATIONAL HOMELAND SECURITY RESEARCH CENTER
DECONTAMINATION AND CONSEQUENCE MANAGEMENT DIVISION

I. TITLE

Decontamination Line Protocol Evaluation for Biological Contamination Incidents using Electrostatic Spray

II. PERIOD OF PERFORMANCE

The period of performance for the work under this work assignment shall be Award – 3/31/17.

III. SUMMARY OF OBJECTIVES

This work will examine the different stages/steps in the decon line and the effectiveness of each stage in preventing cross contamination of individuals or outside area using electrostatic stray as the personnel decontamination spray decontamination system. The results of this evaluation shall be compared to those identified in EPA Report EPA.600/R-14/476, 2015

IV. RELEVANCE

The purpose of the decontamination line is to assure that any potentially harmful or dangerous residues, on persons or equipment are confined within the Exclusion "Hot" Zone. The decontamination line is intended to prevent the spread of contaminants beyond the already contaminated area, including to other personnel and other environments. Information from this study can be used to determine the effectiveness of the current configuration or provide additional suggestions for improvement. Electrostatic spray shall be used to evaluate the efficacy, as well as reduction of water and wastewater generated during decontamination incidents.

V. BACKGROUND

Under Homeland Security Presidential Directive (HSPD) 10, the U.S. Department of Homeland Security (DHS) is tasked to coordinate with other appropriate Federal departments and agencies, to develop comprehensive plans which, "provide for seamless, coordinated Federal, state, local, and international responses to a biological attack." As part of these plans, the U.S. Environmental Protection Agency (EPA), in a coordinated effort with DHS, is responsible for "developing strategies, guidelines, and plans for decontamination of persons, equipment, and facilities" to mitigate the risks of contamination following a biological weapons attack.

EPA's National Homeland Security Research Center (NHSRC) provides expertise and products that can be widely used to prevent, prepare for, and recover from public health and environmental emergencies arising from terrorist threats and incidents. NHSRC's Decontamination and Consequence Management Division (DCMD)'s decontamination research program's goal is to provides expertise and guidance on the selection and implementation of decontamination methods and provide the scientific basis for a significant reduction in the time and cost of decontamination events.

NHSRC works with EPA's Office of Emergency Management's (OEM) which has revised the biological decontamination line based on the previous NHSRC PPE decontamination study. The current version of the decontamination line to be evaluated attached.

VI. SCOPE

The purpose of this study is to determine the effectiveness of each stage in the decontamination line procedure in preventing cross contamination of individuals or outside areas.

VII. TECHNICAL APPROACH

The contractor, upon approval from the EPA WACOR, shall procure all test equipment and materials to be included in this project. The contractor shall work with the EPA WACOR to develop the Quality Assurance Project Plan (QAPP) and test plan. The EPA WACOR will assemble a team of EPA employees that will assist in the development of this project and provide feedback on the progress.

VIII. AFFORDABILITY

The contractor shall procure all test materials/equipment. The work is expected to be conducted at EPA's Research Triangle Park Facility.

IX. TECHNICAL RISK

The technical risk involved in this project is minimal. The ultimate goal is to determine the efficacy of the use of electrostatic spray in controlling the spread of biological organisms.

X. FACILITIES AND MATERIALS

All experimental efforts shall be performed by the contractor at the U.S. EPA's facilities located on the U.S. EPA campus in Research Triangle Park, NC. The contractor shall provide all staff and materials.

XI. TASKS

The work to complete the tasks listed below shall be conducted at facilities located on EPA's Research Triangle Park, NC campus. The deliverable dates and availability of vendor-supplied equipment shall be used by the contractor, in consultation with the EPA WACOR, to determine the testing schedules.

The following tasks are defined as part of this work assignment:

Task 1 – Preparation of Work Assignment Work Plan

A detailed Work Plan is due 20 calendar days after receipt of the approved Work Assignment. Content shall be in accordance with terms and conditions of the contract.

Task 2 – Develop the QAPP/Test Plan

A test/quality assurance plan shall be developed in accordance with EPA Guidelines for Preparation of Quality Assurance Project Plans (QAPP) and NHSRC Quality Management Plan (QMP). The test/QA plan shall detail roles/responsibilities, experimental methods, quality assurance/quality control measures, and data management and analysis procedures. A draft test/QA plan shall be provided to EPA for review. Upon receipt of EPA review comments, a revised test/QA shall be prepared for EPA QA and peer review. EPA QA and peer review comments shall be incorporated into the final test/QA plan. No data collection shall begin until the QAPP is approved by the EPA COR.

The contractor shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form (QARF)" included with this work assignment (see Attachment #1 to the SOW) and the NHSRC QA requirement as defined in Attachment #2 to the SOW. The QAPP must be approved prior to the start of any work. Additional information related to QA requirements can be found at: http://www.epa.gov/quality/qs-docs/r5-final.pdf.

The contractor shall work with EPA WACOR to develop a test plan that will evaluate the decontamination line procedure that is included as Attachment A to this SOW.

Task 3 – Determination of Test Materials and Test Matrix
The contractor shall determine any test materials and equipment that are required to complete this work assignment. The list of materials shall be approved by the EPA WACOR prior to purchase.

Task 4 – Evaluation of the Decontamination Line Procedure
The contractor shall conduct the testing described in the QAPP that will be developed as part of Task 2. The decontamination line procedure is included as Attachment A.

Methods used in the initial PPE decontamination line protocol evaluation shall be applied to test the use of electrostatic spray.

One additional aspect that shall be considered is the transfer of samples from the hot zone to the cold zone.

The contractor shall develop the health and safety research protocol (HSRP) for this work and obtain approval from the contractor and U.S. EPA health and safety officers prior to commencement of any studies. Additionally, the contractor shall adhere to all requirements for use of humans in research due to the involvement of workers in generating data.

Task 5 – Reporting
All data collected per the QAPP shall be submitted to the EPA WACOR within one week after the completion of the analysis. Submission shall be via posting on the NHSRC share drive and by hard copy to the WACOR.

Bi-weekly meetings shall be scheduled between the contractor WAL and the EPA WACOR to discuss relevant results. Meetings may also include other members of the EPA project team.

The contractor shall submit a draft report on the compilation of test results. The report shall include photographic and graphical documentation, where appropriate, to support the findings. The report shall be provided in both hardcopy and electronic (MS Word) format. The draft report will be reviewed by the EPA WACOR and EPA QA Manager. Comments will be sent to the contractor to incorporate into a revised report. The contractor shall revise the report and provide a final draft within two weeks of receiving comments from the EPA WACOR.

XII. DELIVERABLE SCHEDULE

- On a monthly basis for the duration of the project, the contractor shall submit, in electronic format, progress reports summarizing technical progress (including estimated percent of project completed), problems encountered, quarterly and cumulative financial expenditures and cost and schedule variance.

- A draft report shall be delivered to the EPA WACOR by 1/31/14.

Table 4: Deliverable Schedule

Deliverable	Date
QAPP/Test Plan	1 month after WA award
Data summaries	On-going
Draft Report	2/1/2017
Final Report	2 weeks after receiving review comments

XIII. REPORTING REQUIREMENTS

- The Contractor shall prepare Quality Control data reports of all facility-specific data. Each Quality Control report shall be in a format suitable for EPA/NHSRC publication and shall discuss how well various measurements described in the QA plan were met.
- The monthly invoice reports for this work assignment shall provide a detailed description of any equipment or expendables that have been purchased by the contractor for use on the projects discussed herein.
- In lieu of a final technical report, journal papers within each task may be submitted at the discretion of the EPA WACOR. The papers shall be authored or co-authored by the EPA WACOR, at the discretion of the WACOR. To serve in lieu of the final report, the journal articles must contain all of the relevant information that would have appeared in the final report.
- All products developed under this SOW (e.g., the above mentioned technical report) must conform to the requirements of EPA's Handbook for Preparing Office of Research and Development Reports (EPA/800/K-95/002). Substantive portions of this handbook can be found at www.epa.gov/nhsrc under the policy and guidance tab.

Attachment A

Long Term Decontamination Line Procedure

Purpose

The purpose of this standard operating procedure (SOP) is to provide evaluated protocols to EPA staff and contractors regarding decontamination (decon) of personnel operating in an environment contaminated with a biological agent. This SOP was developed specifically for an Ebola response where Modified Level C Personal Protective Equipment (PPE) with a full-face powered air purifying respirator (PAPR) is used. Modified Level C PPE was appropriate for the 2014 outbreak of the Ebola virus.[1] Level C PPE is defined as using air purifying respirators, a protective Saranex™ or equivalent liquid resistant coverall with integral hood and booties, inner and outer nitrile gloves, hard hat (optional), and chemical resistant (e.g. BATA) boots.

This document may be modified based on site/situation specific conditions and/or exigencies relevant to a particular response action. Responding personnel should attempt to comply with the strategies and tactics presented in this document. However, if it is necessary to modify the following protocols due to unique site issues the intent of these protocols should be adhered to and deviations/modifications documented.

Background EPA's National Homeland Security Research Center (NHSRC) Study

The NHSRC published *Decontamination Line Protocol Evaluation for Biological Contamination Incident, Assessment and Evaluation Report* (EPA Report EPA/600/R/476, 2015). This report evaluated EPA's 2010 "Long Term Biological Decontamination Line SOP." The results of NHSRC's study found that liquid can be a contaminant carrier, so unless a completely effective liquid decontaminant (e.g., diluted bleach or registered disinfectant) is used, large amounts of liquids and scrubbing should be avoided, due to the potential of cross-contaminating personnel through their PPE. The use of a secondary protective Tyvek™ suit, under the main Tychem™ suit, along with a light mist or spray, and careful doffing (with attendant help, wearing multiple gloves, frequently doffed) can reduce, or potentially eliminate cross

[1] PPE level may be upgraded based upon the decontamination agent being used on site.

contamination to the personnel. Because total elimination of cross contamination cannot be guaranteed 100% of the time, all personnel exiting the biological decon line should thoroughly shower with a disinfectant soap immediately after removing PPE, and before exiting to uncontrolled areas. Special consideration must be given to the handling procedure to avoid and eliminate any cross contamination from equipment that was used in the hot zone into any areas outside the doffing and decontamination areas.

Personal Protective Equipment

The PPE Ensemble

Hot Zone (HZ) teams and decon line (DL) attendants will be required to don modified Level C PPE. Regulations regarding what is considered Level C PPE can be found in 29 CFR 1910.120 App B, Section B. Required PPE includes the following:

1. **Double Suit**
   a. Inner suit – Paper Tyvek or equivalent with integral hood and booties (socks), 1-2 sizes larger than typically worn to allow easy removal without cross-contamination.
   b. Outer suit[2] - Chemical resistant, splash-proof coveralls with integral hoods and booties (socks) that meet the requirements of North America ASTM Standards F1670 and ASTM F1671, such as TyChem SL or QC. The coveralls must be coated and impermeable to a 10% bleach solution with a 5 minute contact time. Again, a slightly larger size than usual (1 or 2 sizes larger than usual) will help prevent cross-contamination during doffing on the decon line.

2. **Gloves**
   All gloves (other than additional outer work glove) must be NFPA 1999 compliant, for medical use. Do not use food service or industrial gloves.
   a. Inner protective gloves – thin (~ 4 mil) surgical nitrile, with long wrist gauntlets (mid-arm, or a few inches beyond the wrist); worn under the inner Tyvek and not taped.
   b. Outer protective gloves – same as above; over inner Tyvek and taped.
   c. Work gloves - Any gloves worn outside of these 2 protective layers are considered to be task-specific "work" gloves, and should be selected based on the entry zone or decon worker's tasks:
      i. For HZ workers, thicker or specialty gloves for equipment-handling or rough work should be donned, and then doffed and discarded before entering decon.
      ii. For DL workers, additional layers of nitrile gloves will be donned and doffed, as required, for preventing cross-contamination during decon line work.

Workers should write their names on all durable PPE they want returned to them.

3. **Outer Boots**
   Chemical resistant outer boots with steel toe and shank. Size one or two larger than usual, due to TyChem suit boots. **Do not use safety shoes or boots with mud-covers or galoshes.**

---

[2] Note: For chemical resistant suits manufactured by DuPont, only TyChem SL or QC series suits have been tested against (and passed) the requirements of North America ASTM Standards F1670 and ASTM F1671, which describe the standards of materials resistant to infectious materials. SL or QC suits are not available in a configuration with smaller face openings or boot flaps.

4. **Suit Tape**
   Use Chemtape.

5. **Masks**
   a. PAPRs and filter cartridges are recommended for clear vision thru the facepiece, or
   b. APRs and filter cartridges if PAPRs are not available.
      c. Combo-filters (P-100 particulate + chlorine) due to bleach use for disinfection.
      d. Face pieces should have voice amplifiers attached <u>and turned on</u>.

6. **OSHA-compliant Level C PPE**
   As described in 29 CFR 1910.120 App B, Section B describes Level C components and is reproduced in part here:
   a. Level C - The concentration(s) and type(s) of airborne substance(s) is known and the criteria for using air purifying respirators are met.
   b. The following constitute Level C equipment; it may be used as appropriate:
      1. Full-face ... air purifying respirators (NIOSH approved).
      2. Hooded chemical-resistant clothing (overalls; two-piece chemical-splash suit; disposable chemical-resistant overalls).
      3. Coveralls.
      4. Gloves, outer, chemical-resistant.
      5. Gloves, inner, chemical-resistant.
      6. Boots (outer), chemical-resistant steel toe and shank.
         ...
      8. Hard hat.
         ...

7. **Under Suit Clothing**
   HZ and DL workers wearing PPE will be required to wear clothing that will be bagged prior to showering (as part of decon). Staff dressing out must bring a change of clothing to wear after showering. Bagged clothing can be taken home for laundering.

Donning PPE

- Check in with medical monitoring before donning PPE.
- Donning PPE must be done in a dry area so that tape will properly adhere to surfaces.
- Recommended procedure (assuming under suit clothing is already on):
  1. Put on inner gloves <u>(no tape);</u>
  2. Put on inner suit (Tyvek), leaving hood off;
  3. Put on outer gloves <u>and tape to the inner Tyvek suit</u>;
  4. Put on outer suit (TyChem), leaving hood off;
  5. Tape outer suit sleeves to outer gloves (gloves under sleeves), ideally with at least one layer of tape around each wrist, leaving no gaps, with a tab for removal. Get assistance if needed;

6. Put on outer boots, using care not to break the seams near the feet on the inner and outer suits;
7. Tape outer boots to outer suit, ideally with at least one layer around each calf, leaving a tab for removal. Get assistance if necessary;
8. Don PAPR or APR facepiece; turn on PAPR blower; remove any cartridge caps on PAPR filters;
9. With assistance, pull inner suit hood on, covering all skin around facepiece. Use one small piece of tape to secure the inner hood to the facepiece, near the rim of the visor. This keeps the inner hood in place when removing the outer suit hood;
10. With assistance, pull outer suit hood on, positioning hood borders by facepiece;
11. Have assistant tape outer hood to mask, leaving no exposed skin. Care must be used to close the throat area, ensuring the outer suit will remain zipped and closed, while not being so constrictive as to disturb the seal of the facepiece on the skin. Ensure that taping does not severely restrict the head/neck range of motion, and that head movement does not cause tearing in the suit. Practice normal head movements with the assistant observing to ensure taping does not cause a breach in the neck area;
12. Write person's name on front and back of outer suit, in large clear letters. Designate DL workers clearly ("DECON" on outer suits, or colored tape), to aid in distinguishing decon and entry personnel. If possible, consider purchasing different colored outer suits, as an aid in distinguishing teams (i.e., decon versus entry).

Personnel Decon Procedure

The decon line should be constructed with materials durable enough to withstand continued use for the time necessary to complete the decontamination process. If possible, decon tent or structures should be utilized. Tents, berms, and collection vessels should be able to maintain wastewater in a contained and safe manner. Procedures should be in place to treat and replace contaminated materials used during the decon process as well as replace necessary chemicals and decontamination solutions. This type of robust decon set up may be appropriate if a prolonged decon process is anticipated (i.e., multiple days). Due to large liquid waste volumes collected during prolonged operation, additional measures to remove bulk amounts of grey water from the decon line should be considered.

All personnel are required to train, practice, and be proficient with the site-specific decon procedures prior to entering the Hot Zone (HZ)/Exclusion Zone (EZ). This includes an initial walk though of the decon line prior to entry into the HZ.

A single decon line should consist of a minimum of four decon attendants that will verbally direct and assist decon workers through each step of the process, and perform decon of durable PPE as it is collected. The decon line will also have a dedicated Supervisor with

responsibility to ensure compliance with the Ebola Decon Line procedures discussed below. Additionally, the Safety Officer (SO) or Assistant Safety Officer (ASO) will supervise the decon line to provide an additional perspective and ensure compliance with the decon process. A "critical items list" for Supervisor's use is included in this SOG, as well as decon line equipment lists.

Disposal of Decon Waste: ***Note that an appropriate disposal facility should be identified (as well as any and all Department of Transportation (DOT) packaging criteria) for receiving the waste prior to producing any decon solid (PPE) and/or liquid wastes.*** All efforts should be taken to minimize the production of decon wastewater. Any wastewater that is generated must be transferred into containers that are acceptable for transportation (e.g., comply with DOT requirements in accordance with the arraignments with the disposal facility). It may be appropriate to treat (i.e., "shock") the wastewater with bleach.

The "Biological Decon Line" SOG consists of the following steps*:

** Note - Step 1 below will be conducted in the Hot Zone ("HZ", sometimes referred to as the Exclusion Zone "EZ"), while Steps 2-7 will occur in the Contamination Reduction Zone ("CRZ", sometimes referred to as the Warm Zone) and Steps 8 & 9 will occur in the Support Zone ("SZ", sometimes referred to as the Cold Zone).*

Gross decontamination should occur in the HZ if and when PPE comes in contact with body fluids. Recommend considering the use of a surfactant or soap to aid in gross contamination removal.

Step #1: Tool and Instrument Drops:

Tools and instruments (separate areas for each) will either be reused if more than one entry is planned, or will be decontaminated and/or disposed.[3]

Exiting Hot Zone (HZ) Worker:

- Place all tools and/or instruments in the appropriate drop areas (covered table or lined container) provided, prior to entering the decon line.

Decon Line (DL) Attendant:

- Establish communication with each exiting HZ worker, ask if they feel okay, have any issues, etc.
- Look for holes or tears in HZ Worker's outer PPE.

Step #2: Outer Boot and Glove Wash

The purpose of this initial step is to remove gross contamination. Note that task-specific work gloves should already have been discarded in the HZ.

HZ Worker:

- Step into provided basins and wash outer gloves and outer boots using the designated decontamination solution, 1:10 diluted household bleach (i.e., one part 5-9% *sodium hypochlorite* bleach per nine parts water) or a registered disinfectant according to the label.[4]
  - There may be multiple outer boot and glove washes, place and use them at the HZ exit as well as the front of the decon line.

---

[3] Responders may need to consider decontaminating equipment if it will be reused or leave in the EZ if the task is not completed at the conclusion of the entry.

[4] Designated decontamination solution is an EPA-registered disinfectant against non-enveloped viruses (e.g., norovirus) (http://www.epa.gov/oppad001/chemregindex.htm, List G), for example, diluted bleach (1:10 dilution of bleach containing 5-9% sodium hypochlorite). The compatibility of the decontaminant with the PPE material should also be considered when selecting PPE and the designated solution.

DL Attendant:

- Change outer glove and boot decon solution at least once every 4 hours, more often if it appears unfit for use.

Step #3: Glove, Boot, and Suit Wash:

HZ Worker:

- Step into a contained area (large tub or basin) within the decon line.
- Turn PAPR off, and loosely cover filter inlets to deflect spray from entering the filters.

DL Attendant:

- Mist all outer surfaces of the worker using a pressurized spray mist with the designated decontamination solution. (Can possibly use or build a standing spray tent/area that constantly mists the bleach solution). Use fine mist tips for the sprayers - gives better misting coverage, less "run-off".
- Achieve a uniform spray mist, rather than wet wash down.
- Begin by decontaminating the worker's boots and gloves.
- Then decon the entire suit by wetting all surfaces, including the PAPR casing[5].
- Ensure that all areas are decontaminated (with careful attention given to the zipper, arms, front torso, and any other area that could have come in contact with contamination/
- **Maintain a wetted surface for 5 minutes. Use timer if available.**
- Contain the solution used for decontamination. (Liquid waste will be collected, and disposed of properly from the decontamination line when all workers and attendants have been decontaminated, and/or when the containment area is full, and/or whenever the containment area becomes a potential source of cross-contamination.)

Exercise caution not to generate excess water that could potentially enter the suit(s)

Step #4: Outer Glove, Boot, and Outer Suit Removal

HZ Worker:

- Allow an attendant to guide you to a stool or bench and sit. This bench may straddle or be near a berm; **be sure to keep your feet on the wet side of the berm until your boots are removed.**

DL Attendant:

- Place an open drum liner or large trash bag on the dry side of the bench or stool.
- Remove worker's outer boots and place in boot decon container; **have the worker place his foot into the open bag/liner on the dry side of the bench after removing each boot.**

---

[5] Be careful not to spray decontaminate directly into PAPR cartridge as the cartridge will not be able to filter out a direct spray.

- Remove tape from zipper seams, mask, boots, etc, and place in bag/liner.
- Unzip the outer suit.

HZ Worker (if wearing a PAPR):

- If wearing a PAPR, unfasten the PAPR belt, and take hold of your PAPR blower motor assembly (BMA), without help from attendant, if possible.
- Hold your BMA carefully to ensure that it won't disrupt your mask/face seal.
- Hang belt and BMA from provided hook, hangar or clothesline to free both hands.

DL Attendant:

- Stand behind worker, reach the top of the outer suit and peel downward past the shoulders, turning the suit inside-out.
- Remove your own (i.e., Attendant) outer layer gloves and replace to prevent cross-contamination.
- While touching only the inside of the suit, continue removing the worker's outer suit by carefully rolling it down slowly, using a downward motion from the head/shoulders area all the way down to their feet. **Instruct worker to step out of the bag/liner as each foot is removed from the outer suit.**
- Remove HZ worker's outer gloves and place in bag.
- Remove own (i.e., Attendant) outer layer gloves and replace to prevent cross-contamination.[6]
- Close up and dispose of bag/drum liner.
- Spray any surfaces touched / occupied / vacated by worker (e.g., stool/bench/table tops, etc.) with the designated decon solution as each entry personnel progresses through the decon line.
- Place a new bag/liner on the dry side of the stool/bench for the next worker.

Step #5: Inner Suit Removal

DL Attendant:

- Wipe down the zipper, hood near the mask, and cuffs (area within 6 inches above the wrist) of the worker's inner suit with Hype-Wipe®.[7]
- Focus particular attention on the inner gloves.
- Remove your own outer gloves and replace with new pair of outer gloves.
- Remove the worker's inner suit by carefully rolling it inside out as you go down slowly, using a downward motion from the head/shoulders area all the way down to their feet.
- Place inner suit in trash and use a broom handle or stick to compact the trash.

Step #6: Mask Removal

HZ Worker:

- If wearing a PAPR, unscrew the hose from the BMA.

---

[6] Attendant should consider use of antibacterial liquid sanitizer on inner gloves before replacing outer glove.

[7] Or other hospital-grade disinfecting/cleaning towelettes saturated with sodium hypochlorite equivalent

- While still wearing your inner gloves, doff your mask and hose by looking downwards and pulling your mask down and away from your chin.
- Remove cartridge filters and place into trash.[8] Put mask, PAPR, and hose into designated containers.

DL Attendant:

- Decon line personnel will clean each mask and PAPR assembly (following the steps above or in accordance with the manufacturers guidelines unless specified by the Site Safety Officer) prior to return to service.
  - Due to possible volume of mask face pieces, hoses and BMAs, we recommend a dedicated DL Attendant for this decon line station.

Step #7: Inner Glove Removal & Hand and Face Wash

HZ Worker:

- Remove inner gloves by only touching the outside of the first glove and then only the inside of the second glove.
- Place gloves into designated container.
- Don temporary slippers.
- Proceed to Hand and Face Wash station.
- Wash hands and face with soap and warm water after all PPE has been doffed and prior to entering into the personal shower. Hand and face wash station should allow for clean running water and soap for each individual; do not use "community use" containers or basins. Hand wash stations can be rented or purchased.

Step #8: Personal Shower

This is an extremely important step in minimizing secondary contamination. Showering should be conducted as soon as possible. ***Note:*** *this step may be modified depending upon the site-specific operational period.*

All Workers & Attendants:

- Discard temporary slippers.
- Disrobe, bag clothing worn under PPE, tie off bag and bring thru the shower tent with you.
- Shower using copious quantities of disinfectant soap and water for a minimum of 5 minutes.
- Change into clean clothes.[9]
- Replenish fluids.

---

[8] Recommend HEPA cartridges for workers, the attendants should consider HEPA + Cl2 if they spend much time on the decon line.

[9] The pre-deployment equipment list should include a clean change of clothes for all workers.

Step #9: Medical Monitoring

All Workers & Attendants:

- Report to the medical monitoring station for their post entry monitoring and meet with appropriate personnel for debriefing.
- Comply with the HASP's monitoring and reporting requirements (e.g., monitoring for temperature, blood pressure, pulse, etc.).

Emergency Egress Corridor:

An emergency egress line must be established. This line will be used to quickly decon personnel who have medical emergencies while in the HZ. Personnel must be decontaminated prior to receiving treatment from emergency medical technicians or transported to a hospital. Garbing of the person being transported will be in compliance with the ambulance/EMT requirements. Back-up entry teams should plan to respond to calls for assistance in bringing injured or incapacitated HZ workers thru the emergency egress corridor, while performing/assisting the DL attendants with decon on the incapacitated worker.

Items needed for Emergency egress corridor:

1. Surgical scissors or other safety cutter for removing PPE;
2. Litter or other suitable carrier for incapacitated workers;
3. Blanket or tarp for covering the litter;

Recommended decon procedure for incapacitated workers:

1. When the emergency egress corridor is going to be used to expedite decon and egress, it must be cleared of any other personnel; anyone in the corridor should exit toward either the front or rear, depending on their level of possible contamination. Anyone in the corridor who has a possibility of being contaminated must exit toward the hot zone, before the injured worker enters it.
2. Assuming the incapacitated worker is at the decon line, perhaps brought by other workers, the decon line supervisor should notify at least 2 back-up team members to come to the front of the decon line (thru the emergency egress (EE) corridor), with the litter / stretcher, covered by one tarp. Place the incapacitated worker onto the tarp on the litter, face-up. Any HZ workers escorting the incapacitated worker can then return to work or exit thru the decon line as usual.
3. Supervisor should ensure 9-1-1 has been called or call if no one has done so already, informing the medical responders that the patient is being deconned and will arrive at the support zone in just a couple minutes. Ask if they want the patient wrapped or if they prefer to perform that themselves. Ensure other IC staff are notified immediately about the situation, once 9-1-1 is notified.
4. The back-up team members will carry the worker on the litter thru the EE corridor.
5. The outer suit will be misted or it can be wiped thoroughly with Hype-wipe. Alternatively, a car-wash mitt dipped in decon solution can be used to wipe the outer suit.
6. Outer suit may be cut off depending on the injury. Cut the <u>outer suit</u> only away from the worker's body and making a long incision with medical scissors from the neck to below the waist, and an incision from below the waist down each leg to the heel. Use caution when

removing the outer suit particularly the hood, being careful not to disturb the mask seal on the face.

CRZ Breakdown

The Decon Line Supervisor will be responsible for watching the DL Attendants break down of the CRZ. The direction of breakdown starts at the HZ and works towards the SZ. All solid waste (e.g. used PPE, poly sheeting, etc.) will be collected, consolidated and appropriately sealed in accordance with packaging requirements. Items that require decontamination during this process include, stools, wash basins, and any other items that will be reused. All liquid waste shall be collected. Liquid waste will be collected and transferred into the minimum number of appropriate containers (e.g. drums, totes, etc.) and will be dispose in accordance with the local, state, and federal regulations and applicable requirements.

Decon Line Supervisor and Attendants

After the decon line is secured, the DL Attendants shall doff their PPE following Steps 2-9 above, whereby the most contaminated Decon Line Attendant (typically the individual closest to the EZ) becomes the "Worker" and the other Attendants move forward one place closer towards the EZ until all Attendants have become "Workers" (for the purpose conducting decontamination in this Decon Line SOP). The last Attendant will need to perform their own decontamination from start to finish.

- Since the EPA OSCs are responsible for monitoring the successful decontamination of all personnel, the Decon Line Supervisor should be the last person through the decon line. If that is not feasible, then another EPA OSC in the SZ should monitor the final decon phases from the SZ.

Disassembly of Decon Line

A final doffing station must first be established by placing a sheet of heavy duty (e.g., 2 mil) plastic on the ground just outside of the CRZ in the Support Zone with a hand-wash station (see below). Breaking down the decon line may be conducted in Modified Level D (i.e., Tyvek™, nitrile gloves and boot covers). Caution must be exercised to minimize cross-contamination of any residual viruses that may be on the decon line structures. All disposable items will be double-bagged and packaged to comply with the transportation and disposal requirements. Liquid and solid waste should be kept separate. After completion of disassembly of the decon line, these personnel will move onto the final doffing station, doff their PPE, containerize as appropriate, wash their hands and faces and comply with HASP requirements. A final inspection should be conducted to determine if the decon pad area needs to be sprayed down after disassembly.

The last 3 sections can be summarized as:

1. DL workers drum all wastes and liquids **(except for what they need to clean themselves)**, once HZ workers have all exited thru decon. Dry floor on wet side.

2. Clean (wipe or spray) and push out (thru support zone) all unneeded containers, seats, tools and instruments from drop area. Leave large tubs and berms in place.
3. DL workers pair up and proceed thru all DL stations (2nd gross decon thru hand/face wash and exit). Last pair sets up sump or contains any liquids as they leave wet ops, using extra gloves as needed, before proceeding to dry side of decon.

Follow-up level D (no breathing zone protection needed, no liquids) team can complete removal of berms and large tubs, and lastly perform final tent collapse when dry.

References

EPA NHSRC (2015), Decontamination Line Protocol Evaluation for Biological Contamination Incidents, Assessment and Evaluation Report, EPA/600/R-14/476, 2015

CDC (2008). Guidance on Emergency Responder Personal Protective Equipment (PPE) for Response to CBRN Terrorism Incidents. DHHS, NIOSH.

NIOSH (1985). Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, NIOSH, OSHA, USCG. EPA.

NIOSH (2009). "Recommendations for the Selection and Use of Respirators and Protective Clothing for Protection against Biological Agents" NIOSH Publication Number. 2009-132 29 CFR, Part 1910, Section 134, Respiratory Protection.

EPA Emergency Responder Health and Safety Manual.

Suggested Decon Line Equipment List:

1 Large tent (Stations 2-7 recommended footprint is roughly 24' X 50')
1 24'x50' tarp/visqueen sheet
1 20'x30' tarp
12 2' x 3' bins for standing in
5 18" x 24" bins for washing hands, face, collecting BMAs, etc
8 folding tables (roughly 2' x 6')
4 garden sprayers/ Hudson sprayers/car wash mitts
6 55 gal drums for trash
4 multi-seat benches or stools
1 large inner containment for several stools or benches, to contain decon during 1st suit wash
1 Hat rack/PAPR hanger/clothesline
8 5 gal buckets
16 anti-slip mats
6 seats for reconstitution area
2 5'x5' basins or large containers for bagged trash (from decon line ops)
2 liquid waste drums, open head, poly, lids available
2 kitchen timers, for stay time/ wet time at station 3
1 drum dolly for moving liq. waste drums
1 shower trailer / system for station 8
6 paramedic sheets (for emergency decon use)
1 litter / stretcher
1 surgical scissors / safety suit cutter
2 8'x10' tarps for patient wrap
2 20' berms (for containing wet ops area)
2 hand and face wash stations with running water

Decon Line Consumable supplies list

- Water
- Bleach
- Soap – antibacterial
- gloves (4 mil nitrile or equivalent)
- Trash bags
- Drum liners (one per each worker deconned)
- Hype-wipe, biocidal wipes
- Chemtape
- Hospital Chux / temporary seat covers
- Towels (for shower and face and hand wash areas)
- Temporary foot covers for exiting the CRZ to the shower; disposable courtesy slippers, not old rubber foot covers.

Decon Line Supervisor "Critical List"

Decon Line Supervisors should observe the operations of each decon line attendant, with that worker's duties in mind. Supervisor can review the list of activities at each station on pages 2-4 of this SOG. Each station has specific tasks that must be performed to ensure everyone who exits the decon line is indeed clean. Below are some items that may deserve special attention.

General

- ☐ Have signage and instructions at each decon step/station, so roles and responsibilities are clear. Consider printing the previous instructions in large font and placing in clear covers at each station.
- ☐ Use the Emergency Egress corridor to supervise all areas; this corridor is mostly unused and provides a relatively clean and clear position to oversee all stations.
- ☐ All HZ and DL workers should have staged a change of clothes in the post-shower area prior to beginning work.
- ☐ All HZ and DL workers should have no skin showing; check especially around the mask and throat area, giving guidance or assistance as needed.
- ☐ All HZ and DL workers should receive a decon line walk-thru brief, with explanations at each station, prior to entering the hot zone.
- ☐ Supervisor may need to "control traffic" if the emergency egress corridor is used concurrently with regular decon ops. HZ workers escorting an incapacitated worker may barge into the line, back-up entry teams may attempt to assist without full PPE, etc. Remind workers to respect the process.
- ☐ Watch the volumes / amounts of supplies available and waste volumes as they build. Bulk amounts of "dry waste" (all trash except for the liquids) can be handed across the emergency egress corridor to waste storage; full liquid waste drums can be lidded and dollied to the same location.
- ☐ Consider pre-mixing bleach and soap solutions for supply to the decon line.
- ☐ Decon line workers should not cross the berm and benches/stools where wet and dry operations are separated. Wet DL workers stay in wet area.
- ☐ Floor of dry ops (steps 5-7) in DL should stay dry; have attendant on dry side keep floor dry with mats, Hospital Chux, or pads.

At each station:

- ☐ Tool and instrument drops
  - ➢ Have exiting workers separate these items;
  - ➢ Any extra PPE worn downrange should be removed and placed here or in a trash container at this step.

- ☐ Outer boot and glove wash
  - ➢ Keep decon solution relatively clean; have attendant replace as necessary, at least once per 4 hours.
  - ➢ DL worker should greet each exiting HZ worker, checking for responsiveness and welfare.

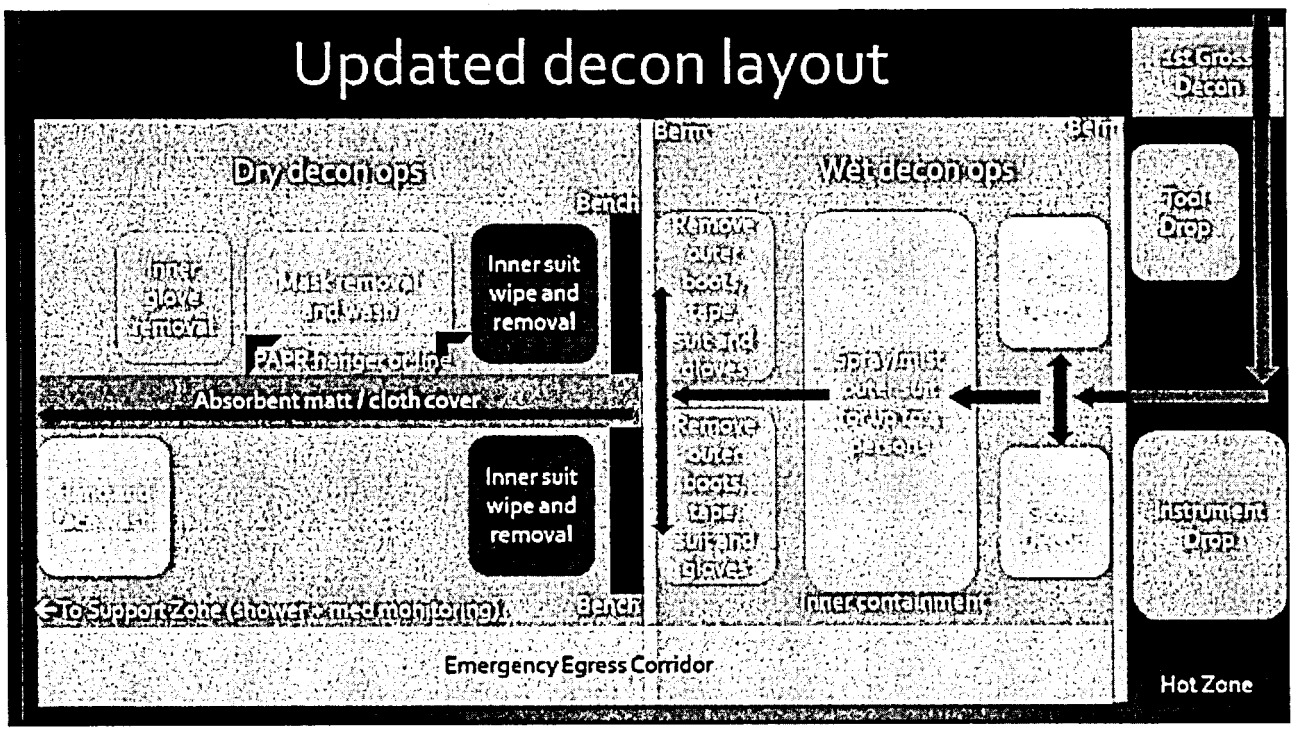
- ☐ Outer suit, boot and glove wash (disinfection);
  - ➢ Need a large enough area to process multiple workers (up to 4) simultaneously;
  - ➢ Use curtains or tarps to limit overspray, Use timers to ensure good contact time.
  - ➢ Ensure workers get completely sprayed/wiped and remain wet for the entire contact time

- ☐ Outer PPE doff
  - ➢ Be certain workers and attendants are clear about the steps to be followed at this station.
  - ➢ Attendant performs all PPE removal, instructing the worker where and when to sit, stand, and place their feet as PPE is removed.
  - ➢ Exiting workers move from wet to dry decon ops at this station; DL workers should not cross this line (keep wet and dry area DL workers separate).
  - ➢ Attendants must avoid cross-contamination by removing and replacing outer gloves as they handle clean and dirty parts of the worker's PPE.

- ☐ Inner suit wipe and removal
  - ➢ Ensure attendant is performing an effective wipe of the arm cuffs, zipper, hood near the mask, and inner gloves before any PPE is removed.
  - ➢ Attendant should not break the worker's mask seal as the inner suit is doffed.

- ☐ Mask removal
  - ➢ Decon line must be able to handle both PAPR and APR-wearing workers; step 6 will need an extra container for PAPR blowers.
  - ➢ Decon line worker can perform decon of face pieces and move these to support zone for air dry and recovery by workers.

- ☐ Inner glove removal and face wash
  - ➢ Exiting workers can perform this themselves, but face/hand wash station must be kept clean and supplied with water and soap.



The above diagram is an example of how steps 1-7 (described earlier in this document) can be implemented. Red arrows represent workers movement path to exit hot zone thru decon. This updated layout was the result of a 2-day exercise specifically implementing this decon line SOG, with after-action review by all players and observers. The steps are:

1) An initial gross decon should be conducted in the hot zone if any 'wet' body fluids are observed on worker's PPE. This should consist of spraying the affected area with bleach and wiping off the material. Work gloves should also be doffed in the hot zone.
2) Tool and Instrument drop – better to separate these, rather than having 1 Equipment drop, as tolls are sturdy and likely to be contaminated, whereas instruments are delicate and less likely to be contaminated.
3) Gross Decon (outer boot and glove wash) – use more than one of these. One at the immediate exit from the hot zone, another immediately prior to disinfection. Minimizes chances of bringing bulk amounts of infectious material out of the hot zone.
4) Disinfection (Glove, suit and boot wash) – need a large area where up to 4 workers can be simultaneously disinfected via spray/mist/wash, and remain for the required contact time. This is the primary bottleneck to the decon line process.
5) Outer PPE doff – having 2 locations with enough room to properly remove the outer suit will help prevent cross-contamination, a major concern for Ebola.
6) Inner suit doff – moving to a "dry" side provides more safety and comfort as workers have no shoes and less foot protection as they remove PPE.
7) Mask removal – this layout uses a dedicated decon line worker to wash and rinse masks (and hoses if PAPRs are used) and store/clean PAPR blowers.
8) Inner glove removal and hand/face wash – spreading these out some to allow for using eye-wash or field stations rather than basins, is more sanitary and appealing to the workers.

Shower facilities and medical monitoring are conducted in the support zone.

Signs for Decon Line

Provided are generic signs for Decon Line. Decon Line Supervisors are encouraged to meet with their personnel to customize these signs for specific decon line set-ups.
Steps should not be eliminated, only clarified.
Adding pictures is encouraged.

Tool Drop

Place all tools in the appropriate drop area (covered table or lined container) provided, before entering the decon line.

Instrument Drop

Place all instruments in the appropriate drop area (covered table or lined container) provided, before entering the decon line.

Outer Boot and Glove Wash

Step into basins and wash outer gloves and outer boots.

NO SPLASHING

Glove, Boot, and Suit Wash

Hot Zone (HZ) Worker:

- Step into basin within the decon line.
- If wearing PAPR, turn blower off, and loosely cover filter inlets to deflect spray.

Decon Line (DL) Attendant:

- Mist all outer surfaces of the worker using a pressurized spray mist with the decon solution.
- Achieve a uniform spray mist, not a wet wash down.
- Begin with the worker's boots and gloves
- Then decon the entire suit by wetting all surfaces, including the PAPR casing, if worn.
- Ensure that all areas are wetted - check the zipper, arms, front torso, and any area that could have come in contact with contamination
- **Maintain a wetted surface for 5 minutes.**

Exercise caution not to generate excess water that could potentially enter the suit(s).

Outer Glove, Boot, and Outer Suit Removal

HZ Worker:

- Allow an attendant to guide you to a stool or bench and sit. This bench may straddle or be near a berm; **be sure to keep your feet on the wet side of the berm until your boots are removed.**
- If wearing a PAPR, unfasten the PAPR belt, and take hold of your PAPR blower motor assembly (BMA), without help from attendant, if possible.
- Hold your BMA carefully to ensure that it won't disrupt your mask/face seal.
- Hang belt and BMA from hangar to free both hands.

Outer Glove, Boot, and Outer Suit Removal

DL Attendant:

- Place an open drum liner or large trash bag on the dry side of the bench or stool.
- Remove worker's outer boots and place in boot decon container; **have the worker place his foot into the open bag/liner on the dry side of the bench after removing each boot.**
- Remove tape from zipper seams, mask, boots, etc, and place in bag/liner.
- Unzip the outer suit.
- Stand behind worker, reach the top of the outer suit and peel downward past the shoulders, turning the suit inside-out.
- Remove your own (i.e., Attendant) outer layer gloves and replace to prevent cross-contamination.
- While touching only the inside of the suit, continue removing the worker's outer suit by carefully rolling it down slowly, using a downward motion from the head/shoulders area all the way down to their feet. **Instruct worker to step out of the bag/liner as each foot is removed from the outer suit.**
- Remove HZ worker's outer gloves and place in bag.
- Remove own (i.e., Attendant) outer layer gloves and replace to prevent cross-contamination.
- Dispose of worker's gloves and suit in bag/liner.
- Spray any surfaces touched / occupied / vacated by worker (e.g., stool/bench/table tops, etc.) with the designated decon solution as each entry personnel progresses through the decon line.

- Place a new bag/liner on the dry side of the stool/bench for the next worker.

Inner Suit Removal

DL Attendant:

- Wipe down the zipper, hood near the mask, and cuffs (area within 6 inches above the wrist) of the worker's inner suit with Hype-Wipe®.
- Focus attention on the inner gloves.
- Remove your own outer gloves and replace with new pair of outer gloves.
- Remove the worker's inner suit by carefully rolling it inside out as you go down slowly, using a downward motion from the head/shoulders area all the way down to their feet.
- Place inner suit in trash and use a broom handle or stick to compact the trash.

Mask Removal

HZ Worker:

- If wearing a PAPR, unscrew the hose from the blower.
- While still wearing your inner gloves, doff your mask and hose by looking downwards and pulling your mask down and away from your chin.
- Remove cartridge filters and place into trash.
- Put mask, PAPR, and hose into designated containers.

DL Attendant:

- Decon line personnel will clean each mask and PAPR assembly prior to return to service.

Inner Glove Removal & Hand and Face Wash

HZ Worker:

- Remove inner gloves by only touching the outside of the first glove and then only the inside of the second glove.
- Place gloves into designated container.
- Proceed to Hand and Face Wash station.
- Wash hands and face with soap and warm water after all PPE has been doffed.

NO SPLASHING

Proceed to shower area.

All personnel must shower to complete the decon process.

After showering, check in with Medical Monitoring.

Emergency Egress Decon Procedure

Recommended decon procedure for incapacitated workers:

- Decon line supervisor should notify at least 2 back-up team members to come to the front of the decon line (thru the emergency egress (EE) corridor), with the litter / stretcher, covered by one tarp.
- Place the incapacitated worker onto the tarp on the litter, face-up. Any HZ workers escorting the incapacitated worker can then return to work or exit thru the decon line as usual.
- Supervisor should ensure 9-1-1 has been called or make that call now, informing the medical responders that the patient is being deconned and will arrive at the support zone in several minutes. Ask if they want the patient wrapped or if they prefer to perform that themselves.
- Ensure other IC staff are notified immediately about the situation, once 9-1-1 is notified.
- The back-up team members will carry the worker on the litter thru the EE corridor.
- The outer suit will be misted or it can be wiped thoroughly with Hype-wipe. Alternatively, a car-wash mitt dipped in decon solution can be used to wipe the outer suit.

- Cut the outer suit only away from the worker's body and making a long incision with medical scissors from the neck to below the waist, and an incision from below the waist down each leg to the heel. Use caution when removing the outer suit particularly the hood, being careful not to disturb the mask seal on the face.

Decon Line Supervisor "Critical List"

General

- Have signage and instructions at each decon step/station, so roles and responsibilities are clear. Consider printing the previous instructions in large font and placing in clear covers at each station.
- Use the Emergency Egress corridor to supervise all areas; this corridor is mostly unused and provides a relatively clean and clear position to oversee all stations.
- All HZ and DL workers should have staged a change of clothes in the post-shower area prior to beginning work.
- All HZ and DL workers should have no skin showing; check especially around the mask and throat area, giving guidance or assistance as needed.
- All HZ and DL workers should receive a decon line walk-thru brief, with explanations at each station, prior to entering the hot zone.
- Supervisor may need to "control traffic" if the emergency egress corridor is used concurrently with regular decon ops. HZ workers escorting an incapacitated worker may barge into the line, back-up entry teams may attempt to assist without full PPE, etc. Remind workers to respect the process.
- Watch the volumes / amounts of supplies available and waste volumes as they build. Bulk amounts of "dry waste" (all trash except for the liquids) can be handed across the emergency egress corridor to waste storage; full liquid waste drums can be lidded and dollied to the same location.

- Consider pre-mixing bleach and soap solutions for supply to the decon line.
- Decon line workers should not cross the berm and benches/stools where wet and dry operations are separated. Wet DL workers stay in wet area.
- Floor of dry ops (steps 5-7) in DL should stay dry; have attendant on dry side keep floor dry with mats, Chux, or pads.

Station-specific checks on reverse

At each station:

- Tool and instrument drops
  - Have exiting workers separate these items;
  - Any extra PPE worn downrange should be removed and placed here or in a trash container at this step.
- Outer boot and glove wash
  - Keep decon solution relatively clean; have attendant replace as necessary.
  - DL worker should greet each exiting HZ worker, checking for responsiveness and welfare.
- Outer suit, boot and glove wash (disinfection);
  - Need a large enough area to process multiple workers (up to 4) simultaneously;
  - Use curtains or tarps to limit overspray, or have attendants use car-wash mitts dipped in decon solution;
  - Use timers to ensure good contact time.
  - Ensure workers get completely sprayed/wiped and remain wet for the entire contact time.
- Outer PPE doff
  - Be certain workers and attendants are clear about the steps to be followed at this station.
  - Attendant performs all PPE removal, instructing the worker where and when to sit, stand, and place their feet as PPE is removed.
  - Exiting workers move from wet to dry decon ops at this station; DL workers should not cross this line (keep wet and dry area DL workers separate).
  - Attendants must avoid cross-contamination by removing and replacing outer gloves as they handle clean and dirty parts of the worker's PPE.
- Inner suit wipe and removal
  - Ensure attendant is performing an effective wipe of the arm cuffs, zipper, hood near the mask, and inner gloves before any PPE is removed.
  - Attendant should not break the worker's mask seal as the inner suit is doffed.
- Mask removal

    - Decon line must be able to handle both PAPR and APR-wearing workers; step 6 will need an extra container for PAPR blowers.
    - Decon line worker can perform decon of face pieces and move these to support zone for air dry and recovery by workers.
- Inner glove removal and face wash
    - Exiting workers can perform this themselves, but face/hand wash station must be kept clean and supplied with water and soap.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-100

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base X Option Period Number	

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — **Accounting and Appropriations Data** — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Robert Vanderpool (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7877 FAX Number:	
Project Officer Name Robin Baily (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:	
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:	
Contracting Official Name Mark Cranley (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109	

Performance Statement of Work

WA Title: Reference & Equivalent Methods Program Support

WA #: 1-100 WACOR: Robert Vanderpool

Contract #: EP-C-15-008 Alternate WACOR: Jonathan Krug

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

By agreements with the Office of Air Quality Planning and Standards (OAQPS), the National Exposure Research Laboratory (NERL) of the Office of Research and Development (ORD) provides research and development of new air monitoring methods and associated quality assurance procedures in connection with new or existing national ambient air quality standards (NAAQS). Research and technical support to NERL's Reference and Equivalent Methods Program is needed which will include (1) development and/or revision of Federal reference methods, (2) technical review and evaluation of formal applications received by EPA for reference and equivalent method determinations under 40 CFR Part 53 as amended December 18, 2006, (3) technical support related to the operation, performance, and quality assurance of existing reference or equivalent methods and their implementation in national air monitoring networks, and (4) research on new measurement technologies.

BACKGROUND

The Reference and Equivalent Methods Program is carried out by the ORD in support of the OAQPS compliance air monitoring program to implement the national ambient air quality standards under regulations at 40 CFR 50 and 58. NAAQS are currently established for six pollutants: SO2, NO2, O3, CO, Pb, and particulate matter (PM10, PM2.5 and PM10-2.5). By agreement with the OAQPS, the National Exposure Research Laboratory and ORD provide (a) the necessary research for the development of new Federal reference methods (FRMs) for ambient air monitoring coincident with the establishment of new NAAQS, (b) development of reference and equivalent method designation requirements associated with new FRMs, (c) primarily technical and associated administrative services to evaluate and process applications for reference and equivalent method determinations and related activities under regulations at 40 CFR 53, as amended December 18, 2006, (d) research, investigation, and (if required) development of remedial techniques to resolve technical or implementation issues that may arise in the use of designated reference and equivalent methods in OAQPS's ambient air surveillance networks, and (e) development of new quality assurance procedures in connection with new

or existing NAAQS. The Air Quality Branch (AQB) of NERL is currently responsible for administering this program.

SCOPE

The contractor shall carry out activities related to the processing and technical evaluation of reference or equivalent method applications under EPA regulations at 40 CFR 53, as revised December 18, 2006. The various activities that are required under this task are described in the "Reference and Equivalent Methods Program and Procedures Handbook" (RTI/7490/042-2D), May 2007. The contractor shall carry out only those tasks identified as not inherently governmental in nature.

TECHNICAL APROACH/OBJECTIVES

Task 1. Technical Evaluation of Reference and Equivalent Method Applications.

The specific task requirements for evaluation of each reference or equivalent method application may vary somewhat depending upon the specific circumstances of the particular application, which cannot be known until the application is received. In order to meet the 120-day regulatory deadline to respond to applications, the contractor shall evaluate and process each application expeditiously and in all cases shall complete the work not more than 110 calendar days after assuming custody of the application documents. In cases where additional information pertinent to a pending application is received subsequent to the first application review, the contractor shall continue the review activities to consider the new information, with an appropriate extended due date. To accommodate these conditions, the WA COR will issue a written technical directive to the contractor for each application to be processed, with copies furnished to the Project Officer (PO) and to the Contract Officer (CO). Each such technical directive will identify the application to be evaluated, specify any minor deviations in the evaluation protocol for the application, and identify the target date by which the deliverable(s) are to be provided to the WA COR.

The actual number of applications to be processed and the dates on which they will be received and available for processing is not known. However, it is assumed that evaluation of up to twelve (12) applications will be required during the course of this Work Assignment. The contractor shall process applications as soon as practicable such that processing of any application is not unduly delayed by the processing of any other application. Technical evaluation and processing of requests for approval of modifications to existing reference or equivalent methods or similar requests shall be processed similarly, as appropriate to the nature of the request, with necessarily shorter completion times appropriate to the shorter regulatory deadline (30 days) for such requests. Any application materials identified as confidential business information (CBI) shall be treated in accordance with CBI regulations and policy restrictions.

Task 2. Investigation of Technical Issues

In support of the reference and equivalent methods program, the contractor shall conduct laboratory and/or field tests and/or other research activities, as appropriate or necessary, related to the investigation and resolution of potential measurement anomalies, interferences, or other technical deficiencies associated with samplers, analyzers, measurement principles or techniques used in designated reference or equivalent methods or related to a pending application. The contractor's work plan shall anticipate up to four (4) such investigations of modest scope. When such a support need arises, the WA COR will issue a written technical directive describing the technical question or issue to be investigated, the scope of the investigation, and the nature of the deliverable needed. If the nature of the issue is such that the scope of the investigation and/or its resolution will require substantial labor hours beyond the amount anticipated in the approved work plan, the contractor, upon receiving such a technical directive, shall prepare a research plan of specific activities to resolve the issue and an associated cost estimate. After review and acceptance of the plan, a written amendment to this work assignment may be issued for the contractor to conduct the proposed work.

QUALITY ASSURANCE (QA)

Standard "good laboratory practices" for maintaining notebooks shall be employed.

The contractor shall follow the protocols, procedures and guidelines of the "Reference and Equivalent Methods Program and Procedures Handbook" as revised May 2007.

Calibration and operation of scientific instruments shall be performed under existing SOPs contained in the Quality Assurance Project Plan (QAPP) "Maintenance, Management, Operation, and Analysis of the Aerosol Test Facility", which will be revised and updated under WA# 1-100.

DELIVERABLES

Work Plan. A work plan containing a cost estimate shall be provided to the Contracting Officer (CO), PO and WA COR.

Revised QAPP. A revised Quality Assurance Project Plan (QAPP) "Maintenance, Management, Operation, and Analysis of the Aerosol Test Facility" shall be provided to the WA COR for review and approval by the WA COR and NERL QA Manager prior to the start of work on the Work Assignment.

Task 1. Technical Evaluation of Reference and Equivalent Method Applications.

Preliminary results from the wind tunnel evaluation of the prototype inlets shall be provided in the form of spreadsheets and Word documents. Both hard copy and electronic formats of results shall be provided.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-102

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name: 1-102

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 1, 6

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Timothy Barzyk
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-1520
FAX Number:

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Contractor will need to be able to access and code CCAT and finalize the analytical ranking portions, which were designed specifically for CCAT.

TECHNICAL APROACH/OBJECTIVES

Task 1. Finalize CCAT QAPP

Initial development of a CCAT QAPP has begun but is still in draft stages. The Contractor shall finalize the CCAT QAPP in accordance with EPA guidelines, and then submit the QAPP for approval.

Task 2. Finalize and Incorporate Analytical Modules (Supports Task 4.61.5)

2.a. Perform Risk Characterization

The Contractor shall develop the risk characterization module to synthesize key information about a risk into "concerns" (i.e., detailed profile of a risk) which will be used in subsequent "risk/concern ranking" module. This is the information that the CCAT user needs to evaluate "how many times more important one concern is compared to another." Risk information to be taken into account include:

- hazard's nature (e.g., chronic/long-term or acute/single event)
- severity (the combination of hazard and exposure, e.g., hazard's extent and magnitude, possible impact on community/ecosystem)
- likelihood of a risk as a whole (again, the combination of hazard and exposure)
- uncertainty in information/judgment

The Analytical Network Process (ANP) model in combination of BSCT will be used extensively in this module. The use of BSCT reduces the burden of pairwise comparison in the ANP model significantly.

2.b. Identify Management Actions

The Contractor shall develop this module to identify a set of potential management actions with respect to the imminent risks. There are a several different ways to implement this module. In this early stage of development, this module can be as simple as a list of known actions (e.g., a project, program) carried out by other communities and/or suggested by EPA in dealing with a particular risk. From the suggested list the user will choose some feasible actions which are reasonable to the community's resources and socio-economic and cultural conditions. Later on, the module can be developed to include other sophisticated options such as a simulation model developed by EPA or other agencies (e.g., the effects of various best management practices on erosion control).

2.c. Characterize Management Actions

The Contractor shall develop this module to characterize and/or quantify potential actions (e.g., a project, program) in terms of their effects and cost (in hard numbers, e.g., $, number of cases, environmental indicators, probability of success). From the modeling perspective, this module is similar to Risk Characterization.

2.d. Sensitivity Analysis

The Contractor shall examine options for including sensitivity analysis into CCAT. Generally speaking, there are three ways to look at the sensitivity of an action in a CCAT model:

- Perturbation sensitivity: understanding how perturbations in the model inputs change the most preferred action or make the action invariant
- Core stability: finding the region of the action space in which the action remains most preferred
- Action stability: finding the regions of the action space in which different actions are most preferred

Task 3. Guided Case Study Example (Supports Task 2.62.3)

Before the beta release, CCAT needs at least one well-developed guided example (i.e., with step-by-step instructions) and a couple of pre-loaded case study examples which would serve as a guide to users about what is an objective, what is a criterion, what is a concern, etc? This would include a glossary of terms and definitions as they are being used in the CCAT process, and general instructions about working through the CCAT steps. The Contractor will not need to perform case studies from scratch; the WACOR will provide information and technical direction regarding previously conducted case studies, which the Contractor can then incorporate into CCAT.

Task 4. Formatting and Implementation (Supports Task 2.62.3)

The Contractor shall incorporate any revisions and formatting requirements necessary to complete the CCAT beta version. The Contractor shall work with the WACOR to provide the following and related functionality:

- Update all drop-down menu selections
- Include hyperlinks throughout to relevant materials
- Revise introductory text, descriptions, help boxes, and instructions (i.e., any written text) for each module
- Provide references for each module that relate its structure and methods to the published literature

WA SPECIFIC EQUIPMENT

No WA-specific equipment is anticipated for this project.

QUALITY ASSURANCE

The Contractor shall confirm significant methodological and technical modifications with the WACOR throughout development, and document decisions related to software design and module functionality. The Contractor shall utilize the associated SOPs from the OTIE QMP (i.e., SOPs listed in Table 8-1) for all technical developments. The Contractor shall use the existing OTIE QMP, Contract Quality Management Plan for the Technical Support for Regional Vulnerability Assessment (ReVA) project (Revision 4, May 2011) and/or the "Development of ORD/NERL's Community-Focused Exposure and Risk Screening Tool (C-FERST) and Tribal-Focused Environmental Risk and Sustainability Tool (Tribal-FERST)" QAPP (June 24, 2013) to help develop a project-specific QAPP and related SOPs for this project. EPA Guidance for Quality Assurance Project Plans for Modeling (QA/G-5M) (http://www.epa.gov/quality/qs-docs/g5m-final.pdf) will be used as necessary to ensure the essential QAPP components are addressed in the project-specific QAPP. The project-specific CCAT QAPP will be delivered within 60 days of the onset of this work assignment.

DELIVERABLES

The main deliverable is a beta-version of CCAT. Modules are often developed in tandem, and incorporation of case study information is dependent on module completion. Formatting and revisions can be ongoing, but final revisions cannot be made without a full beta version. Therefore, deliverables are grouped into three categories (based on the tasks), with a schedule that will allow all three to be addressed.

Deliverables:

1) Project-specific CCAT QAPP
2) Final analytical development of ranking algorithms and incorporation into CCAT
3) Development of a guided example (and potentially other general examples)
4) Final revisions and formatting

SCHEDULE of DELIVERABLES

Task Deliverables	Expected Delivery Date
1. QAPP	Within 60 days of onset

2.a-d. Analytical development and incorporation	September 30, 2016
3. Guided and case study examples	January 30, 2017
4. Final revisions	March 20, 2017

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-102

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base Option Period Number: 1

Title of Work Assignment/SF Site Name:

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:
The purpose of this amendment is to add Task 5 to the PWS of this work assignment.

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Timothy Barzyk
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-1520
FAX Number:

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name:
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Development of Community Decision Analysis Software

WA #: 1-102 WACOR: Timothy Barzyk

Contract #: EP-C-15-008 Alternate WACOR: Bruce Mintz

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

The primary objective of this SOW is to finish a beta version of the Community Cumulative Assessment Tool (CCAT), which is currently in a prototype stage of development (i.e., partially complete). A beta version means that all CCAT modules are operable, from beginning to end, even if final edits or minor modifications still need to be made, but the method itself is usable from the first step to the last. Finalizing the beta version includes: 1) finalizing quantitative modules (risk ranking and management action modules); 2) conducting sensitivity analyses; and 3) including a case study example and general updates.

BACKGROUND

CCAT is being developed by ORD for its Sustainable and Healthy Communities (SHC) research program, and has been nominated for a 2016 Annual Performance Review (APR) as a key product; it is therefore important to advance development of the beta version. CCAT is an environmental decision analysis methodology that is being developed into an interactive software platform. It is designed to help users build a partnership, establish goals and objectives, identify environmental health issues, collect information, rank risks, and identify and prioritize management actions. The beta version will demonstrate the full functionality of CCAT, and how it leverages information from EPA and other tools in order to make informed environmental decisions based on local priorities and resources.

SCOPE

The scope of this SOW is to finalize the computer coding of the CCAT software. This includes finalizing the risk and management ranking algorithms, and sensitivity analysis, and incorporating them into CCAT. The beta version will also include a pre-loaded case study example and general formatting and editing of text. The

Contractor will need to be able to access and code CCAT and finalize the analytical ranking portions, which were designed specifically for CCAT.

TECHNICAL APROACH/OBJECTIVES

Task 1. Finalize CCAT QAPP

Initial development of a CCAT QAPP has begun but is still in draft stages. The Contractor shall finalize the CCAT QAPP in accordance with EPA guidelines, and then submit the QAPP for approval.

Task 2. Finalize and Incorporate Analytical Modules (Supports Task 4.61.5)

2.a. Perform Risk Characterization

The Contractor shall develop the risk characterization module to synthesize key information about a risk into "concerns" (i.e., detailed profile of a risk) which will be used in subsequent "risk/concern ranking" module. This is the information that the CCAT user needs to evaluate "how many times more important one concern is compared to another." Risk information to be taken into account include:

- hazard's nature (e.g., chronic/long-term or acute/single event)
- severity (the combination of hazard and exposure, e.g., hazard's extent and magnitude, possible impact on community/ecosystem)
- likelihood of a risk as a whole (again, the combination of hazard and exposure)
- uncertainty in information/judgment

The Analytical Network Process (ANP) model in combination of BSCT will be used extensively in this module. The use of BSCT reduces the burden of pairwise comparison in the ANP model significantly.

2.b. Identify Management Actions

The Contractor shall develop this module to identify a set of potential management actions with respect to the imminent risks. There are a several different ways to implement this module. In this early stage of development, this module can be as simple as a list of known actions (e.g., a project, program) carried out by other communities and/or suggested by EPA in dealing with a particular risk. From the suggested list the user will choose some feasible actions which are reasonable to the community's resources and socio-economic and cultural conditions. Later on, the module can be developed to include other sophisticated options such as a simulation model developed by EPA or other agencies (e.g., the effects of various best management practices on erosion control).

2.c. Characterize Management Actions

The Contractor shall develop this module to characterize and/or quantify potential actions (e.g., a project, program) in terms of their effects and cost (in hard numbers, e.g., $, number of cases, environmental indicators, probability of success). From the modeling perspective, this module is similar to Risk Characterization.

2.d. Sensitivity Analysis

The Contractor shall examine options for including sensitivity analysis into CCAT. Generally speaking, there are three ways to look at the sensitivity of an action in a CCAT model:

- Perturbation sensitivity: understanding how perturbations in the model inputs change the most preferred action or make the action invariant
- Core stability: finding the region of the action space in which the action remains most preferred
- Action stability: finding the regions of the action space in which different actions are most preferred

Task 3. Guided Case Study Example (Supports Task 2.62.3)

Before the beta release, CCAT needs at least one well-developed guided example (i.e., with step-by-step instructions) and a couple of pre-loaded case study examples which would serve as a guide to users about what is an objective, what is a criterion, what is a concern, etc? This would include a glossary of terms and definitions as they are being used in the CCAT process, and general instructions about working through the CCAT steps. The Contractor will not need to perform case studies from scratch; the WACOR will provide information and technical direction regarding previously conducted case studies, which the Contractor can then incorporate into CCAT.

Task 4. Formatting and Implementation (Supports Task 2.62.3)

The Contractor shall incorporate any revisions and formatting requirements necessary to complete the CCAT beta version. The Contractor shall work with the WACOR to provide the following and related functionality:

- Update all drop-down menu selections
- Include hyperlinks throughout to relevant materials
- Revise introductory text, descriptions, help boxes, and instructions (i.e., any written text) for each module
- Provide references for each module that relate its structure and methods to the published literature

Task 5. Testing and Analysis

The Contractor shall perform bug testing and analysis of results to ensure that CCAT is performing robustly within the calculations of risks ranking and solution prioritization. This will involve basic entry and confirmation that results are reflecting the inputs.

WA SPECIFIC EQUIPMENT

No WA-specific equipment is anticipated for this project.

QUALITY ASSURANCE

The Contractor shall confirm significant methodological and technical modifications with the WACOR throughout development, and document decisions related to software design and module functionality. The Contractor shall utilize the associated SOPs from the OTIE QMP (i.e., SOPs listed in Table 8-1) for all technical developments. The Contractor shall use the existing OTIE QMP, Contract Quality Management Plan for the Technical Support for Regional Vulnerability Assessment (ReVA) project (Revision 4, May 2011) and/or the "Development of ORD/NERL's Community-Focused Exposure and Risk Screening Tool (C-FERST) and Tribal-Focused Environmental Risk and Sustainability Tool (Tribal-FERST)" QAPP (June 24, 2013) to help develop a project-specific QAPP and related SOPs for this project. EPA Guidance for Quality Assurance Project Plans for Modeling (QA/G-5M) (http://www.epa.gov/quality/qs-docs/g5m-final.pdf) will be used as necessary to ensure the essential QAPP components are addressed in the project-specific QAPP. The project-specific CCAT QAPP will be delivered within 60 days of the onset of this work assignment.

DELIVERABLES

The main deliverable is a beta-version of CCAT. Modules are often developed in tandem, and incorporation of case study information is dependent on module completion. Formatting and revisions can be ongoing, but final revisions cannot be made without a full beta version. Therefore, deliverables are grouped into three categories (based on the tasks), with a schedule that will allow all three to be addressed.

Deliverables:

1) Project-specific CCAT QAPP
2) Final analytical development of ranking algorithms and incorporation into CCAT
3) Development of a guided example (and potentially other general examples)

4) Final revisions and formatting

SCHEDULE of DELIVERABLES

Task Deliverables	Expected Delivery Date
1. QAPP	Within 60 days of onset
2.a-d. Analytical development and incorporation	September 30, 2016
3. Guided and case study examples	January 30, 2017
4. Final revisions	March 20, 2017

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-102

☐ Other ☒ Amendment Number: 000002

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base Option Period Number: 1

Title of Work Assignment/SF Site Name:

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2): ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee — LOE:

Cumulative Approved: — Cost/Fee — LOE:

Work Assignment Manager Name: Timothy Barzyk
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-1520
FAX Number:

Project Officer Name: Robin S. Harris
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0955
FAX Number:

Other Agency Official Name:
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Development of Community Decision Analysis Software

WA #: 1-102 WACOR: Timothy Barzyk

Amendment: 2

Contract #: EP-C-15-008 Alternate WACOR: Bruce Mintz

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

The primary objective of this SOW is to finish a beta version of the Community Cumulative Assessment Tool (CCAT), which is currently in a prototype stage of development (i.e., partially complete). A beta version means that all CCAT modules are operable, from beginning to end, even if final edits or minor modifications still need to be made, but the method itself is usable from the first step to the last. Finalizing the beta version includes: 1) finalizing quantitative modules (risk ranking and management action modules); 2) conducting sensitivity analyses; and 3) including a case study example and general updates.

BACKGROUND

CCAT is being developed by ORD for its Sustainable and Healthy Communities (SHC) research program, and has been nominated for a 2016 Annual Performance Review (APR) as a key product; it is therefore important to advance development of the beta version. CCAT is an environmental decision analysis methodology that is being developed into an interactive software platform. It is designed to help users build a partnership, establish goals and objectives, identify environmental health issues, collect information, rank risks, and identify and prioritize management actions. The beta version will demonstrate the full functionality of CCAT, and how it leverages information from EPA and other tools in order to make informed environmental decisions based on local priorities and resources.

SCOPE

The scope of this SOW is to finalize the computer coding of the CCAT software. This includes finalizing the risk and management ranking algorithms, and sensitivity analysis, and incorporating them into CCAT. The beta version will also include a

pre-loaded case study example and general formatting and editing of text. The Contractor will need to be able to access and code CCAT and finalize the analytical ranking portions, which were designed specifically for CCAT.

TECHNICAL APROACH/OBJECTIVES

Task 1. Finalize CCAT QAPP

Initial development of a CCAT QAPP has begun but is still in draft stages. The Contractor shall finalize the CCAT QAPP in accordance with EPA guidelines, and then submit the QAPP for approval.

Task 2. Finalize and Incorporate Analytical Modules (Supports Task 4.61.5)

2.a. Perform Risk Characterization

The Contractor shall develop the risk characterization module to synthesize key information about a risk into "concerns" (i.e., detailed profile of a risk) which will be used in subsequent "risk/concern ranking" module. This is the information that the CCAT user needs to evaluate "how many times more important one concern is compared to another." Risk information to be taken into account include:

- hazard's nature (e.g., chronic/long-term or acute/single event)
- severity (the combination of hazard and exposure, e.g., hazard's extent and magnitude, possible impact on community/ecosystem)
- likelihood of a risk as a whole (again, the combination of hazard and exposure)
- uncertainty in information/judgment

The Analytical Network Process (ANP) model in combination of BSCT will be used extensively in this module. The use of BSCT reduces the burden of pairwise comparison in the ANP model significantly.

2.b. Identify Management Actions

The Contractor shall develop this module to identify a set of potential management actions with respect to the imminent risks. There are a several different ways to implement this module. In this early stage of development, this module can be as simple as a list of known actions (e.g., a project, program) carried out by other communities and/or suggested by EPA in dealing with a particular risk. From the suggested list the user will choose some feasible actions which are reasonable to the community's resources and socio-economic and cultural conditions. Later on, the module can be developed to include other sophisticated options such as a simulation model developed by EPA or other agencies (e.g., the effects of various best management practices on erosion control). The Contractor shall consider both regulatory and non-regulatory approaches as management options. Stakeholders

have expressed interest to consider not only non-regulatory actions at the community level, but to also consider regulatory or policy-based approaches as well. The Contractor shall consider these options with respect to development aspects, such as hierarchy considerations or to provide recommendations to the WACOR about how to incorporate them.

2.c. Characterize Management Actions

The Contractor shall develop this module to characterize and/or quantify potential actions (e.g., a project, program) in terms of their effects and cost (in hard numbers, e.g., $, number of cases, environmental indicators, probability of success). From the modeling perspective, this module is similar to Risk Characterization.

2.d. Sensitivity Analysis

The Contractor shall examine options for including sensitivity analysis into CCAT. Generally speaking, there are three ways to look at the sensitivity of an action in a CCAT model:

- Perturbation sensitivity: understanding how perturbations in the model inputs change the most preferred action or make the action invariant
- Core stability: finding the region of the action space in which the action remains most preferred
- Action stability: finding the regions of the action space in which different actions are most preferred

Task 3. Guided Case Study Example (Supports Task 2.62.3)

Before the beta release, CCAT needs at least one well-developed guided example (i.e., with step-by-step instructions) and a couple of pre-loaded case study examples which would serve as a guide to users about what is an objective, what is a criterion, what is a concern, etc? This would include a glossary of terms and definitions as they are being used in the CCAT process, and general instructions about working through the CCAT steps. The Contractor will not need to perform case studies from scratch; the WACOR will provide information and technical direction regarding previously conducted case studies, which the Contractor can then incorporate into CCAT. The Contractor shall provide technical assistance and advice for the application of CCAT in real-world case studies in which the WACOR is involved. The WACOR is PI or co-PI on projects in North Carolina, Tennessee, and Kansas and intends to apply CCAT to those projects, so the Contractor shall be available to answer technical questions or provide guidance on recommended approaches for CCAT application. The Contractor shall use these examples to develop basic training information to guide a user through the process of building hierarchies and/or making risk ranking decisions. Training information need not be

technically sophisticated, but reflect the approach in a straight-forward manner, such as with step-by-step instructions and images, and/or examples.

Task 4. Formatting and Implementation (Supports Task 2.62.3)

The Contractor shall incorporate any revisions and formatting requirements necessary to complete the CCAT beta version. The Contractor shall work with the WACOR to provide the following and related functionality:

- Update all drop-down menu selections
- Include hyperlinks throughout to relevant materials
- Revise introductory text, descriptions, help boxes, and instructions (i.e., any written text) for each module
- Provide references for each module that relate its structure and methods to the published literature

Task 5. Testing and Analysis

The Contractor shall perform bug testing and analysis of results to ensure that CCAT is performing robustly within the calculations of risks ranking and solution prioritization. This will involve basic entry and confirmation that results are reflecting the inputs. The Contractor shall utilize the example case study information to perform testing and analysis, and report on which factors need further development and refinement. CCAT Beta will include functional aspects, but the Contractor shall also recommend additional refinements to facilitate its use and application by using example real-world information to illustrate their findings.

WA SPECIFIC EQUIPMENT

No WA-specific equipment is anticipated for this project.

QUALITY ASSURANCE

The Contractor shall confirm significant methodological and technical modifications with the WACOR throughout development, and document decisions related to software design and module functionality. The Contractor shall utilize the associated SOPs from the OTIE QMP (i.e., SOPs listed in Table 8-1) for all technical developments. The Contractor shall use the existing OTIE QMP, Contract Quality Management Plan for the Technical Support for Regional Vulnerability Assessment (ReVA) project (Revision 4, May 2011) and/or the "Development of ORD/NERL's Community-Focused Exposure and Risk Screening Tool (C-FERST) and Tribal-Focused Environmental Risk and Sustainability Tool (Tribal-FERST)" QAPP (June 24, 2013) to help develop a project-specific QAPP and related SOPs for this project. EPA Guidance for Quality Assurance Project Plans for Modeling (QA/G-5M)

(http://www.epa.gov/quality/qs-docs/g5m-final.pdf) will be used as necessary to ensure the essential QAPP components are addressed in the project-specific QAPP. The project-specific CCAT QAPP will be delivered within 60 days of the onset of this work assignment.

DELIVERABLES

The main deliverable is a beta-version of CCAT. Modules are often developed in tandem, and incorporation of case study information is dependent on module completion. Formatting and revisions can be ongoing, but final revisions cannot be made without a full beta version. Therefore, deliverables are grouped into three categories (based on the tasks), with a schedule that will allow all three to be addressed.

Deliverables:

1) Project-specific CCAT QAPP
2) Final analytical development of ranking algorithms and incorporation into CCAT
3) Development of a guided example (and potentially other general examples)
4) Final revisions and formatting

SCHEDULE of DELIVERABLES

Task Deliverables	Expected Delivery Date
1. QAPP	Within 60 days of onset
2.a-d. Analytical development and incorporation	September 30, 2016
3. Guided and case study examples	January 30, 2017
4. Final revisions	March 20, 2017

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-103

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Maribel Colon
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-5712
FAX Number:

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Next Generation Air Monitoring Technical Support

WA # 1-103 WACOR: Maribel Colon

Contract #: EP-C-15-008 Alternate WACOR: Ron Williams

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (PWS) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

This work assignment shall provide field and/or laboratory technical support involving the development and deployment of Next Generation Air Monitor (NGAM) technologies. Such efforts shall be associated with operation of the devices under conditions defined by the WA COR to provide for their use to support Environmental Justice (EJ) research taking place in Puerto Rico. To assist the Contractor in understanding the full measure of this WA and development of their cost estimate, a kick off meeting will be held upon award at a time/date of the WA COR selection. It is anticipated this meeting shall occur within one week of the WA initiation date as a project sensitive time line of the project initiation must be maintained in support of this work assignment. This kick off meeting shall involve key Contractor personnel associated with those anticipated to be involved in deployment of low cost sensor technologies.

The Contractor shall conduct efforts related to specific support components of the US Environmental Protection Agency (EPA)'s Office of Research and Development (ORD)/Region 2/ Environmental Justice community research project entitled, "The Efficacy of Citizen Science Air Monitoring for Building Awareness of Exposures for Citizens in a US Caribbean Urban Neighborhood Impacted by Heavy Industrial Contamination" as described below. Herein, this project is simply called the "Encarnación Project." In brief, the Contractor shall develop copies of a sensor pod containing key features specified by the WA COR under technical direction to meet the ultimate field deployment characteristics, validate the operation characteristics of the pod through field and/or laboratory examination, develop a Research Operating Procedure to enable citizens to operate the device successfully, and provide maintenance/repair support once the field activities have been initiated until the completion of the project. A key component of this effort shall be the establishment of a local community liaison who will ultimately organize the citizen scientists from one primary EJ location, ensure proper pod deployment, conduct pod data recovery and data summary activities, and ultimately report lessons learned of the research project as a whole. The research project shall be initiated in CY

2016 with its ultimate completion date estimated to occur by the end of FY 2018 (Only efforts associated with the current period of performance are defined herein).

BACKGROUND

EPA's ORD has been conducting a variety of both laboratory and field based evaluation/deployment of Next Generation Air Monitors (NGAM). This new work assignment will provide for carry-on activities in support of previously defined research plans. These previous efforts have included laboratory and/or field evaluations of numerous criteria air pollutant NGAM devices (e.g., nitrogen dioxide, ozone, particulate matter, volatile organic compounds, and sulfur dioxide). ORD has published findings from some of these efforts through its Citizen Science Air Toolbox website (http://www.epa.gov/air-research/air-sensor-toolbox-citizen-scientists).

During recent years, there have been significant advances in air pollution sensor technology. Specifically, sensors are now being developed that are much smaller and lower cost than traditional ambient air monitoring systems, with promising data. These types of sensors present an opportunity to advance EPA's strategic goals including community monitoring and environmental justice. One of the potential benefits of these sensors is the ability to deploy a larger number of sensors across a small geographic area (e.g. a neighborhood) and collect data with a level of geographic and temporal resolution that would be cost-prohibitive than deployment of traditional regulatory quality monitoring methods. A prime example of such effort include the CSAM (Citizen Science Air Monitor) and the AirMapper sensor pods. Telecommunication and data recovery knowledge involving sensor pods has been gained through the recent CAIRSENSE-Atlanta/Denver project (http://www.epa.gov/air-research/community-air-sensor-network-cairsense-project-lower-cost-continuous-ambient-monitoring) in which the Contractor was involved. All of the aforementioned examples involved ORD collaboration with Regional offices and local community-based environmental justice efforts. This WA will meet similar goals in providing technology to citizen scientists. To the greatest extent possible technology insights from such recent projects will be leveraged here to reduce sensor pod development costs as well as provide for project timeline savings.

SCOPE

The Contractor shall conduct laboratory activities as designated by the WA COR onsite at the EPA-RTP campus as needed in support of securing and developing air quality sensor pods. Discussions between ORD/Region/EJ community will ultimately dictate the full design of the pod. Technical direction by the WA COR will be used to guide key decision making aspects of the pod development. Monthly conference calls shall be established by the WA COR in which the Contractor shall participate. Laboratory/field activities shall involve calibration versus reference monitors. Sensor pods at the discretion of the WA COR shall be evaluated for basic operational status by Region 2 collaborators prior to their ultimate deployment. The WA COR

shall provide technical direction on the NGAM devices to be calibrated under field or laboratory conditions and any pre-study collaborator activities.

Field efforts involving non-local travel requirements shall be limited to a 1 day community training event in Puerto Rico. Local EPA RTP air monitoring platforms (AIRS-EPA RTP campus and/or EPA Triple Oaks Near Road trailer) shall be used as needed to prepare Puerto Rico (PR) Project sensors for the deployment. Onsite RTP laboratories already available to the Contractor shall be used for sensor assembly and laboratory evaluation efforts.

The WA COR shall provide full technical direction on the types, number, and length of deployment involving all NGAM devices. Contractor acquisition of some low cost NGAMs shall be performed under this work assignment with property accounting performed by the Contractor in support of ORD property maintenance requirements.

The resulting screening level data collected during this project may be used by the community to fill data gaps from existing air quality data sources, including Puerto Rico Air Monitoring Network, a network of National Air Monitoring Stations (NAMS), State and Local (SLAMs) and Special Purpose Monitoring sites that include federal reference method (FRM) monitors. The project will utilize these existing sources of ambient air data for initial and periodic sensor collocation for the purpose of data normalization.

TECHNICAL APROACH/OBJECTIVES

Task #1. PR Project Sensor Pod Development

The Contractor shall build a sensor pod system complete with particulate matter (PM), total volatile organic compound (tVOC), nitrogen dioxide, relative humidity, and temperature measuring components. Low cost sensors, such as those examined in the CAIRSENSE, CSAM, and Air Mapper projects, will be the basis for the components ultimately selected by the WA COR for incorporation. For estimating purposes, the Contractor shall leverage to the greatest extent possible, technical lessons learned from these earlier projects. The Contractor for cost estimation purposes shall consider base materials being incorporated into each pod at ~ $1000 and a maximum of 10 pods being developed. It is possible that a unique printed circuit board like that developed for the Air Mapper project will be selected here for inclusion and if so, the WA COR will provide technical direction on its capabilities and features. Internal data storage such as use of an SD card will be a required feature. It is anticipated that the pods will be stationary in their deployment scheme and have both solar power and AC energy systems. The unstable electrical grid nature of the EJ area being somewhat unpredictable necessitates auxiliary solar power features. Even so, modularity, and size features of the pods will be important aspects of the final design approved by the WA COR. The Contractor upon building the pods will then conduct laboratory and field evaluations to ensure the sensors are properly calibrated, responsive, and robust enough for deployment under Puerto Rico environmental

conditions. The evaluations shall be limited to ensuring proper operating status of the devices and not necessarily their full performance features. As an example, examination of the solar power recharge feature would not be expected to require more than 3 days of field deployment effort and no more than 10 days of collocation with RTP-based reference monitors.

Task #2. PR Project Sensor Pod Deployment

The Contractor shall make a site visit to the Tallaboa-Encarnación community in Puerto Rico to roll out the sensor pods. For cost estimation purposes, this shall be in like manner to the recent CSAM roll out performed in Newark, NJ. As part of the roll out, the Contractor shall estimate the cost of shipping the pods in a secure manner to Puerto Rico or EPA's Region 2 (Edison) as per technical direction. The Contractor shall be informed via technical direction if actual shipping to the field site will be necessary. The Contractor shall be responsible for setting up the training agenda, and ultimately providing an estimated 8 hours of hands on training to the EJ community. To meet this end, the Contractor shall ensure the development of a citizen science-based research operating protocol for the pods and a complimentary quality assurance manual. Both English as well as Spanish language versions of both documents shall be developed by the Contractor. In like manner to the recent deployment of the CSAM pods, the WA COR will take draft materials from the Contractor and finalize them to meet EPA formatting requirements. This includes items such as field data logs. The Contractor shall produce the draft materials at least 6 weeks prior to the planned training event to ensure ORD review and approval of said materials. Once sensor pods are deployed by the citizen scientists, the Contractor shall estimate a maximum of $2000 of needed replacement sensor components and a maximum of 40 hrs of repair/refurbishment efforts if pods develop performance issues during their use. Shipping cost for a maximum of 4 pods to the RTP laboratory for repair and their return to Puerto Rico shall be included in the cost estimate.

Task #3. PR Project Community Relations

As was performed in the recent CSAM deployment, a local community EJ liaison will be secured to organize citizen science efforts. The Tallaboa-Encarnación community has working relationships with a number of local groups. Examples include the Desarrollo Integral del Sur and the Ponce Health Science University, among others. The Contractor shall investigate such possibilities and develop a working relationship with such a support group to facilitate the Encarnación Project. The Contractor shall maintain contact with the community liaison in such a fashion that information exchange back to the WA COR on key project goals is performed. Key aspects of this local support shall include: (1) a community liaison who is a community-based local point of contact having an established relationship with the named EJ community including translation of English-based training materials to Spanish language versions, (2) conducting the day to day operation of the sensor pods including general maintenance and data recovery, (3) data validation and summarization, and (4) development of base materials associated with data summaries that can be shared with ORD/Region and with the EJ community. In regards to this last item, the Contractor's community liaison shall envision a WA

COR acceptable PowerPoint-like presentation clearly defining the goals of the project, its features, data findings, example of data summaries, and lessons learned. Said presentation would be shared at a WA COR defined date in a joint meeting involving ORD, Region, and the EJ community and the end of the project expected to occur sometime in the late FY 2018. While this delivery date is beyond the timeline of this particular WA, the Contractor should consider the capabilities of the community liaison to potentially meet such an ultimate goal.

QUALITY ASSURANCE (QA)

Base Quality Assurance Project Plans (QAPPs) and their associated Research/Standard Operating Procedures (ROPs/SOPs) that define a majority of the expected laboratory and field evaluations work are already in existence (NERL QAPPS QAPP-RM-13-01 (1) "Quality Assurance Project Plan – PM and VOC Sensor Evaluation" and QAPP-AB-12-03 "Quality Assurance Project Plan - ORD Sensor/Application Test Bed Challenge: Investigation of App/Sensor Response under Controlled Laboratory Conditions"). A QAPP to cover the sensor pod development shall be developed, which will also include information to cover the laboratory and field evaluations work based on the two existing QAPPs. References to specific sections of the existing QAPP is acceptable. ORD/NERL will develop this particular QAPP as well as have it reviewed/approved by the quality assurance office.

For the sensor pod deployment, an EJ project specific Quality Assurance Project Plan shall be developed. The Contractor and its community liaison will have the prime responsibility for developing this sensor pod deployment QAPP document. The Region 2 Citizen Science Quality Assurance Plan template is the primary document to be used in this process. As an example, the Contractor shall consider the recent CSAM deployment QA Project Plan as the expected level of detail. The WA COR will work directly with the Contractor and its community liaison as well as ORD/NERL and Region 2 quality assurance officials in review and approval of said project quality assurance plan. ORD/NERL will be the Quality Assurance lead in this project.

DELIVERABLES and their Schedule

Task #1 Sensor Pod Development

Deliverable 1.1. The Contractor shall build a maximum of 10 fully functional sensor pods and develop required base operating documentation within 3 months of WA initiation (on or before June 30, 2016). The development of the pods is to be followed by laboratory and field evaluations to ensure the sensors are properly calibrated, responsive, and robust enough for deployment under Puerto Rico environmental conditions as stated under Task #1. Results from the evaluations will be provided to the WA COR.

Task #2 Pod Deployment

Deliverable 2.1. The Contractor shall develop through its Puerto Rico community liaison a study-based citizen science quality assurance project plan. The QAPP shall be reviewed and

approved by the WA COR and EPA ORD (as the lead QA organization with QA manager providing consultation) QA Manager on or before August 1, 2016.

Deliverable 2.2. The Contractor shall develop a WA COR approved training agenda and all necessary training materials (including English and Spanish research operating procedures (ROPs) and a quality assurance manual) to be used in an onsite (Puerto Rico) community training event and conduct said training during the summer of 2016 (on or before August 15, 2016). Routine maintenance/repair of the sensor pod and its components shall be performed through the March 31, 2017 time period as needed.

Task #3 PR Project Community Relations

Deliverable 3.1. The Contractor shall propose and ultimately engage with a WA COR approved community-based EJ Liaison to facilitate citizen scientist training on sensor pod use and sensor pod deployment activities. This support shall be established no later than June 1, 2016.

Deliverable 3.2. The Contractor shall initiate sensor deployment through the local community liaison support by August 15, 2016. Project goals will be clearly defined in the Community EJ Liaison- developed Quality Assurance Project Plan.

Deliverable 3.3. The Contractor shall through its community liaison enable the routine operation of the sensor pods, recover data from said operation, validate recovered data, and establish a working data base (e.g., Excel spreadsheet or other WA COR approved alternatives) through the end of the WA period (March 31, 2017). The Contractor shall develop a WA COR approved text document (e.g., Word) reporting file storage procedures being used in the recovery of the data; data maintenance procedures; data sharing; and data file naming conventions prior to initiation of any data collections. Inclusion of this information into the project specific QAPP shall be the means of delivering this product.

The Contractor shall provide a text-based summary (e.g., Word) of proposed data analysis/data validation plans in advance of all field deployment activities (August 1, 2016). To ensure satisfactory database development, the Contractor shall provide interim versions of the database at least 3 times over the course of the WA period. This includes submission of a draft initial database prior to the start of data collection. WA COR review comments shall be used to improve upon the initial database and all subsequent versions developed under the WA. Key aspects of the data evaluation component of the project will be to ensure that the resulting screening level data collected during this project may be used by the community to fill data gaps from existing air quality data sources, including Puerto Rico Air Monitoring Network, a network of National Air Monitoring Stations (NAMS), State and Local (SLAMs) and Special Purpose Monitoring sites that include federal reference method (FRM) monitors. The Contractor and its EJ Liaison shall utilize these existing sources of ambient air data for initial and periodic sensor collocation for the purpose of data normalization.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-104

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Ronald Williams (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-2957 FAX Number:
Project Officer Name: Robin Baily (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:
Other Agency Official Name: (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name: Mark Cranley (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Next Generation Air Monitoring Technical Support for the South Coast California Air Monitoring Project. Temporal and Spatial Mapping of Air Pollutants

WA #:1-104 WACOR: Ron Williams

Contract #: EP-C-15-008 Alternate WACOR: Rachelle Duvall

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

This work assignment shall provide field and/or laboratory technical support involving the development and deployment of Next Generation Air Monitor (NGAM) technologies. Such efforts shall be associated with operation of the devices under conditions defined by the WA COR to provide for their use to support spatial and temporal environmental assessment in a defined geographical location in southern California. To assist the Contractor in understanding the full measure of this WA and development of their cost estimate, a kick off meeting will be held upon award at a time/date of the WA COR selection. It is anticipated this meeting shall occur within one week of the WA initiation date as a project sensitive time line of the project initiation must be maintained in support of this WA. This kick off meeting shall involve key Contractor personnel associated with those anticipated to be involved in the development and deployment of low cost sensor technologies.

The Contractor shall conduct efforts related to specific support components of an ORD/Region 9 research project entitled, "Sensor Kit Performance Testing and Pollutant Mapping for Community Air Monitoring." Herein, this project is simply called the "South Coast California Air Monitoring Project." In brief, the Contractor shall develop multiple copies of a sensor pod containing key features specified by the WA COR under technical direction to meet the ultimate field deployment characteristics. The basic operational status of the pods shall be established. A Research Operating Protocol and Quality Assurance Guideline document shall be developed. The contractor shall interact with a low-cost sensor evaluation institution separately contracted by the WA COR to support field deployment of the pods.

BACKGROUND

ORD has been conducting a variety of both laboratory and field based evaluation/deployment of Next Generation Air Monitors (NGAM). This new work assignment will provide for carry-on activities in support of previously defined research plans. These previous efforts have included laboratory and/or field evaluations of numerous air pollutant NGAM devices (e.g., nitrogen dioxide, ozone, particulate matter, volatile organic compounds, sulfur dioxide). ORD has published findings from some of these efforts through its Citizen Science Air Toolbox website.

During recent years, there have been significant advances in air pollution sensor technology. Specifically, sensors are now being developed that are much smaller and lower cost than traditional ambient air monitoring systems, with promising data. These types of sensors present an opportunity to advance EPA's strategic goals including community monitoring and environmental justice. One of the potential benefits of these sensors is the ability to deploy a larger number of sensors across a small geographic area (e.g. a neighborhood) and collect data with a level of geographic and temporal resolution that would be cost-prohibitive using traditional monitoring methods. Prime examples of such efforts include the CSAM (Citizen Science Air Monitor) and the Air Mapper sensor pods. Telecommunication and data recovery knowledge involving sensor pods has been gained through the recent CAIRSENSE project. All of the aforementioned examples involved ORD collaboration with Regional offices and local community-based environmental justice efforts. To the greatest extent possible technology insights from such recent projects will be leveraged here to reduce sensor pod development costs as well as provide for project timeline savings. This WA will support the development of low cost sensor technologies that can be used for community monitoring.

SCOPE

The Contractor shall assemble multiple copies of a sensor pod containing particulate matter, ozone, relative humidity, and temperature measurement capability using low cost (<$2500) sensor devices. The WA COR will provide technical direction on the components to be incorporated into each pod. It is estimated that the total cost of critical components to be assembled for each pod will be ≤$1500. The device will require solar power functionality and internal data storage. Discussions between ORD/Region 9 will ultimately dictate the full design of the pod. Technical direction will be used at key decision points of the pod development and selection of components. Basic operational status of each sensor pod shall be established onsite at the EPA-RTP campus. The pods shall then be evaluated for performance characteristics under southern California environmental conditions with an institution separately contracted by the WA COR. Interaction between the Contractor and the California test laboratory shall be required relative to initial training on sensor use and occasional troubleshooting assistance.

Field efforts involving non-local travel requirements shall be limited to a 1 day training event of the local California partner on basic operational principles of the pod and review of Research Operating Procedures (ROPs) and Quality Assurance Guidelines. This might be accomplished by

video conference at the discretion of the WA COR. Local EPA RTP air monitoring platforms (AIRS-EPA RTP campus and/or EPA Triple Oaks Near Road trailer) shall be used as needed to prepare sensor pods for readiness status. Onsite RTP laboratories already available to the Contractor shall be used for sensor assembly and basic operational testing.

The WA COR shall provide full technical direction on the types, number, and length of deployment involving all NGAM devices. Contractor acquisition of some low cost NGAMs shall be performed under this work assignment with property accounting performed by the Contractor in support of ORD property maintenance requirements.

TECHNICAL APROACH/OBJECTIVES

Task #1. South Coast California Air Monitoring Project Sensor Pod Development

The Contractor shall build a sensor pod system complete with particulate matter (PM), ozone, relative humidity, and temperature measuring components. Low cost sensors, such as those used in previous ORD sensor projects, will be the basis for the sensor components ultimately selected by the WA COR for incorporation. For cost estimation purposes, the Contractor shall leverage to the greatest extent possible, technical lessons learned from these earlier projects. The Contractor shall consider base materials being incorporated into each pod at ≤$1500 and a maximum of 10 pods being developed. It is possible that a unique printed circuit board like that developed for the Air Mapper project will be selected here for inclusion and if so, the WA COR will provide technical direction on its capabilities and features. Internal data storage such as use of an SD card will be a required feature. It is anticipated that the pods will be stationary in their deployment scheme and require solar power energy systems. The Contractor upon building the pods will then conduct basic laboratory and field evaluations in or near the RTP campus to ensure the sensors are responsive, and robust enough for deployment under California environmental conditions. Capabilities shall include measurement of fine particulate matter, ozone, relative humidity, and temperature. The evaluations shall be limited to ensuring proper operating status of the devices and not the full performance features. As an example, examination of the solar power recharge feature would not be expected to require more than 3 days of field deployment effort.

Task #2. South Coast California Air Monitoring Project Sensor Pod Training and Troubleshooting

The contractor shall interact with a low-cost sensor evaluation institution (hereby referred to as sensor institution) separately contracted by the WA COR. The Contractor shall make a site visit to the sensor institution and provide 1 day of training on sensor pod operation, installation and quality assurance features that shall be incorporated into all performance testing. As part of the training, the Contractor shall be responsible for shipping the pods in a secure manner to the sensor institution. All training materials (ROPs and Quality Assurance Guidelines)

developed by the Contractor shall be provided to the WA COR for review and approval no less than 1 week prior to the training date. The Contractor shall also provide troubleshooting assistance as needed to the sensor institution. The maximum extent of such assistance shall be 40 hours for estimation purposes.

QUALITY ASSURANCE (QA)

Base Quality Assurance Project Plans (QAPPs) and their associated Research/Standard Operating Procedures (ROPs/SOPs) that define a majority of the expected work are already in existence (NERL QAPPS QAPP-RM-13-01 (1) "Quality Assurance Project Plan – PM and VOC Sensor Evaluation" and QAPP-AB-12-03 "Quality Assurance Project Plan - ORD Sensor/Application Test Bed Challenge: Investigation of App/Sensor Response under Controlled Laboratory Conditions"). The WA COR will work directly with Region 9 to develop a specific project specific Quality Assurance Project Plan. Materials provided by the Contractor (Research Operating Procedures, pod Quality Assurance Guideline, and all pod performance evaluation protocols by the southern California local partner) shall be incorporated into the project QAPP to be developed by the WA COR. The project QAPP will be reviewed and approved by the NERL QA Manager (QA lead) in consultation with the Region 9 QA Manager prior to the start of work on the project, and the Contractor shall abide by the QAPP for this project.

DELIVERABLES and their Schedule

Task #1: South Coast California Air Monitoring Project Sensor Pod Development

Deliverable 1.1. The contractor shall build a maximum of 10 fully functional sensor pods and develop required base operating documentation within 4 months of WA initiation (on or before July 30, 2016).

Task #2: South Coast California Air Monitoring Project Sensor Pod Training and Troubleshooting

Deliverable 2.1. The Contractor shall interact with a sensor institution separately contracted by the WA COR. The WA COR will be a participant in all such interactions. The WA COR will establish periodic meetings of all parties (JTI, California-based sensor institution, Region 9) to gain project updates. The Contractor shall estimate these to represent a maximum of 25 hours over the performance period. The contractor shall provide documents summarizing the performance features of each pod (e.g., Research Operating Protocol(s), Quality Assurance Guidelines, and performance evaluation protocols). The contractor shall also provide 1 day of training on the sensor pod operation to the sensor institution on or before July 30, 2016. The Contractor shall provide a written summary of topics to be covered during the training class no later than 1 month after the training date. As needed, the Contractor shall also provide troubleshooting assistance on the sensor pods to the sensor institution. Said troubleshooting shall consist of telephone and email conversations totaling a maximum of 40 hours over the performance period.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-105

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017
Base Option Period Number 1

Title of Work Assignment/SF Site Name:

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance
From 04/01/2016 To 03/31/2017

Comments:
Work plan due 20 days from date of work assignment.

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Russell Long
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7744
FAX Number:

Project Officer Name Robin S. Harris
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0955
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name Candice Charlton
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2007
FAX Number:

Performance Statement of Work

WA Title: Methods Development, Evaluation, and Applications for Ambient Air Criteria Pollutants, Key Precursor Species, and Meteorological Variables for use in Supplementing Regulatory Monitoring, and Spatial and Vertical Profiling.

WA #: 1-105 **WACOR:** Russell W. Long

Contract #: EP-C-15-008 **Alternate WACOR:** Surender Kaushik

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

The purpose of this project is to evaluate, compare, and apply measurement methodologies for nitric oxide (NO), nitrogen dioxide (NO_2), total reactive nitrogen (NO_Y), sulfur dioxide (SO_2), ozone (O_3), carbon monoxide (CO) and particulate matter (PM) in the atmosphere during both controlled laboratory and ambient (outdoor) based studies. In addition to the previously listed atmospheric pollutants, this effort will also address evaluation, comparison, validation, and applications of methods for measurement of key pollutant precursor species, such as formaldehyde (HCHO), other volatile organic compounds (VOC's), ammonia (NH3) and meteorological parameters. This research effort requires measurement of the above listed pollutants and/or parameters with short time-scale resolution as well as accuracy and precision that were only recently able to be achieved with the commercialization and availability novel measurement technologies. The proposed research effort is intended to provide EPA and stakeholders a comprehensive identification of in-situ and sensor low cost and remote sensing) measurement methods for the above listed pollutant species and meteorological parameters as well as to evaluate and apply these methodologies for spatial and vertical profiling at outdoor research study sites and study areas.

BACKGROUND

Nitrogen dioxide (NO_2), sulfur dioxide (SO_2), ozone (O_3), carbon monoxide (CO) and particulate matter (PM) are regulated as criteria pollutants by the NAAQS. The current federal reference methods (FRMs) for the above criteria pollutants have been established by NERL. By agreement with OAQPS, NERL provides the necessary research for the assessment and development of reference and equivalent methods for ambient monitoring. In an ongoing effort to evaluate EPA's reference methods for availability, accuracy, and sound measurement principles, a variety of measurement methods for the criteria pollutants are currently under investigation.

These methods include new and low cost sensor technologies and remote sensing methodologies for the in-situ determination of many of the criteria pollutants. Long-term, ambient and laboratory inter-comparisons between these emerging techniques and a reference or equivalent method measurement will provide necessary data for method evaluation. Performance characteristics such as, response time, noise, and interferences also need to be evaluated to determine the ability of each technique to serve as routine monitoring methods for the criteria pollutants and identify potential applications of these novel methods including the supplementing of NAAQS monitoring measurements. An additional particular area of interest for these novel methods that needs to be investigated is their applicability in determining both the vertical and spatial distribution of criteria pollutants in a given air shed. In addition to the criteria pollutants, the above mentioned sensor technologies (in-situ low cost and remote sensing) also show promise for measuring important pollutant precursor species, such as formaldehyde (HCHO), other volatile organic compounds (VOC's), ammonia (NH_3) and key meteorological parameters. Likewise, method performance characteristics need to be evaluated for the precursor species and meteorological parameters and to identify potential applications (including vertical and spatial pollutant distribution) of these novel methods. This research effort will also support on-going collaborations between EPA and other Federal (NASA, NOAA) and State agencies in evaluating and applying next generation methodologies in ambient monitoring situations.

SCOPE

NERL performs research for the assessment and development of methods for ambient air monitoring coincident with the establishment of new or revised NAAQS and to supplement and/or enhance regulatory monitoring. The Air Quality Branch is currently responsible for administering the Reference and Equivalent Methods program and managing/coordinating the efforts of evaluating, reviewing and revising and/or updating these methods. Research and technical support is needed in evaluating, revision and/or update current and future regulatory and other (small sensor, remote sensing) measurement techniques.

TECHNICAL APROACH/OBJECTIVES

Task 1. Provide on-site technical support for identification, evaluation, and application of next generation monitoring methods for gas phase criteria pollutants (NO_2 and O_3, CO and SO_2), key precursor species and atmospheric reaction products (including but not limited to NO, NO_x, NO_y, HCHO, NH3, VOCs), PM, and meteorological parameters (temperature, RH, wind speed and direction, mixing layer height, etc.). Based upon technical direction from the WACOR, the contractor shall conduct laboratory and ambient based research activities, as appropriate or necessary, related to the evaluation and application of next generation air monitoring methods for the above listed pollutants and meteorological parameters. The research may include investigation of small sensor and remote sensing measurement technologies and the applicability of these methods to routine and

non-routine ambient monitoring. Small sensor technologies to be investigated include but are not limited to Carclip (or equivalent) electrochemical sensors for ozone and NO2, and Aeroqual gas sensitive semi-conductor sensors for many of the above listed criteria pollutants and reaction product/precursor species. Remote bsensing technology to be investigated include but are not limited to Pandora spectrometers for column measurements of ozone, NO2, SO2, and formaldehyde; ceilometers for mixing layer height. Examples of non-routine monitoring application is the investigation of vertical and spatial distribution of pollutants in an air shed using next generation monitoring techniques. This work will be performed primarily in an ambient setting but may also involve controlled laboratory evaluations. During the ambient and laboratory based studies, the contractor support shall include, deployment of methods to ambient and laboratory sites; set-up, calibration and maintenance (through the electronics shop) of O3, NO2, and other reference instrumentation; daily site/laboratory operation; and data retrieval activities. Under this work assignment, the contractor may be required to purchase select small sensor devices (including sensor consumables and sensor sampling equipment), remote sensing and reference equipment for evaluation and application studies. The WACOR will provide technical directive identifying the sensors, consumables and remote sensing equipment to be purchased. The WA COR will issue technical directive identifying the locations and durations of the laboratory and/or ambient/field studies, technical problem or methodology to be researched or investigated and the scope of the research. It is anticipated that the ambient based studies may be performed at the AIRS sampling site in RTP and at the CAPABLE sampling site at NASA LaRC in Hampton, VA. In addition, it is anticipated that an approximately one month long filed study will be performed along the Wasatch Front in the state of Utah during the Winter 2017. The contractor shall compile the resulting test data and perform numerical and statistical analysis, as needed.

Task 2. Provide support in preparation of peer reviewed journal manuscripts and/or EPA reports - Based upon technical directive from the WACOR, the contractor will prepare necessary materials to be included in a peer reviewed journal manuscript, EPA report and/or other communication products. Materials may include but are not limited to: data from field and laboratory studies; figures and tables to be included in the manuscript/report; manuscript text, etc. The technical directive will identify the materials to be provided and identify the target date by which the deliverable(s) are to be provided to the WA COR.

WA SPECIFIC EQUIPMENT

Work assignment specific equipment for use by the contractor on this work assignment includes but is not limited to:

- Analyzers for NO2, NOy, O3 and other criteria pollutant methods for use as primary and secondary NAAQS FRMs/FEMs.

- Next generation air monitoring methods including remote sensing and small sensor technologies for the gas phase criteria pollutants and meteorological parameters.
- Calibration and data acquisition equipment.
- Mobile monitoring shelters for use during field studies.

The WACOR will issue technical directive identifying the work assignment specific equipment to be used under each task.

QUALITY ASSURANCE

The contractor shall follow the detailed quality assurance project plan (QAPPs) "Methods Development, Evaluation, and Applications for Ambient Air Criteria Pollutants, Key Precursor Species, and Meteorological Variables" (QAPP is under review, number TBD) for the tasks mentioned in the above section. This QAPPs covers laboratory and ambient methods and procedures relevant to this Work Assignment.

DELIVERABLES

A work plan containing a cost estimate shall be provided to the Contracting Officer (CO), PO and WA COR within 20 days of receipt of the Work Assignment or as specified in the contract.

The contractor shall provide deliverable(s) as indicated in each technical directive.

Progress on ancillary support shall be documented in the monthly reports, and shall be provided on an as-needed basis.

SCHEDULE of DELIVERABLES

The schedule for deliverable(s) will be provided in each technical directive.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-106

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base Option Period Number 1	Chemistry Investigations

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: Tasks 1 - 3

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 11/08/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2): ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Surender Kaushik	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-5691 FAX Number:
Project Officer Name Robin S. Harris	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-0955 FAX Number:
Other Agency Official Name	(Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Candice Charlton	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2007 FAX Number:

Performance Work Statement

WA Title: Computational Chemistry Investigations of Reactions Involving Atmospherically Relevant Hydrocarbons with Oxides of Nitrogen

WA #: 1-106 **WACOR:** Surender Kaushik

Contract #: EP-C-15-008 **Alternate WACOR:** Tadeusz Kleindienst

PERIOD OF PERFORMANCE

CO Issuance through March 31, 2017.

SUMMARY OF OBJECTIVES

1. To apply computational chemistry (COMPCHEM) to determine yields, lifetimes and fates of atmospheric compounds under a variety of conditions (oxidant loads, temperature, pressure) in order to improve upon existing chemical mechanisms.
2. To utilize COMPCHEM methods to explore new atmospheric reactions of interest that may be difficult to quantify experimentally.
3. To the extent to which (1) and (2) are successful, use COMPCHEM to improve chemical mechanisms in air quality (AQ) models.
4. Beyond objectives (1) and (2), determine the extent to which COMPCHEM can be used to predict atmospheric lifetimes and fates of compounds that can adversely impact climate change.
5. Beyond objectives (1) and (2), determine the extent to which COMPCHEM can be used to predict atmospheric lifetimes and fates of toxic compounds that can adversely impact human health and/or damage sensitive ecosystems.
6. Conduct chamber and modeling studies of the smog chamber chemistry to improve understanding of the gas-phase chemistry of ozone, nitric acid, air toxics, and SOA formed in reactive hydrocarbon (HC)/NO_x, HC/OH, or HC/NO_3 systems.

BACKGROUND

Toxic compounds may either be emitted or produced in the atmosphere. The production and degradation rates for regulated species such as $PM_{2.5}$, O_3 and NO_x are imprinted upon a complex chemical mechanism that maps the interconversion of all atmospheric constituents. With field measurements, it is extremely difficult to disentangle all relevant reactions because of their sheer number and degree of coupling. In the laboratory, only a small subset of reactions has been studied in relatively 'simplified atmospheres', which are not always adequately representative. Therefore, highly sensitive techniques that are not constrained by detection limits are desired to help unravel atmospheric chemistry.

The highest degree of sensitivity and spatial resolution available to study molecular interactions are afforded by computational chemistry methods. The theoretical foundation of quantum mechanics and advancements in computational power have enabled the detailed study of a wide variety of reactions where interactions may be probed at the chemical bond level with a high level of accuracy. In principle, any reaction may be studied although larger chemical systems warrant either larger computer clusters or more computational time to complete. Computational chemistry is increasingly being applied to explore atmospheric reactions. Common reactions such as OH or O_3 oxidations of hydrocarbons as well as new pathways are being considered to improve our understanding of atmospheric chemical mechanisms. This is particularly important for the development of air quality models because reactions represent the sources and sinks of air pollutants that are being tracked. From a regulatory perspective, it is imperative to improve the accuracy of such models because they are being used to develop control strategies in noncompliant regions in the US. As such, computational chemistry is well poised to make a substantial impact in environmental regulations and policies.

SCOPE AND TECHNICAL APPROACH

Task 1. Computational Chemistry Investigations of chemical processes controlling secondary and tertiary products of hydrocarbon reactions important under high NO_X conditions.

NO_x is a central player in the atmospheric chemistry of urban environments. After the hydroxyl radical has initiated the oxidation of hydrocarbons, NO_x readily reacts with the generated peroxy radicals. The main result of this sequence is the production of two prominent atmospheric pollutants: NO_2 and O_3. However, alternative pathways exist with the major one giving rise to organonitrates that sequester some of the NO_x, at least temporarily. Unfortunately, a range of branching ratios have been measured for this pathway and the properties of this crucial reaction as well as other competing reactions are not well understood. Density functional theory (DFT) calculations have been applied to characterize the potential energy surface (PES) of peroxynitrites derived from isoprene. It was found that the branching ratio that produces organonitrates as well as NO_2 is governed by loose transition states. The dissociated biradical van der Waals (vdw) complex that acts as a reactant for both fragmentation and isomerization pathways exhibits multireference character that may not be captured well with DFT calculations. Consequently, the contractor shall perform higher level computational chemistry calculations on the dissociative reactant and transition states in NO_x reactions. In particular, the contractor shall use coupled-cluster theory (CCSD(T) method), which has shown great promise in treating dynamical electron correlation and is considered to be the 'gold standard' of *ab initio* chemistry. While this is a single-reference method, it can approximate the multi-reference character of biradical vdw complexes. For the isoprene system, the contractor shall conduct 30 single point CCSD(T) calculations of all stationary and transition states of the potential energy surface derived at the M062x/aug-cc-pVTZ level for two oxidized isoprene nitrite isomers.

The intensive nature of CCSD(T) calculations warrants the use of computer clusters using software capable of performing electronic structure calculations (such as Gaussian 09, GAMESS, CFOUR etc.). The contractor may perform single point calculations, geometry optimizations, potential energy mapping (nudged elastic band) and vibrational frequency analyses to develop a detailed potential energy surface for new NO_x reactions of interest (for example multi-nitrate formation, aromatic and alkyl nitrates – totaling approximately 30 calculations). Graphic depictions for these reactions using

appropriate visualization software should be provided which may include reaction coordinate and/or vibrational frequency animations. The output of these calculations will be used as input into time-dependent, multiple-well, master equation solvers such as VARIFLEX or MESMER. Solutions to the master equation will be used to predict thermal rate constants and product yields as a function of temperature and pressure. The contractor shall travel to the EPA campus in the Research Triangle Park to present a summary of the results of the calculations in a couple of face-to-face meetings.

Task 2. A computational investigation of the oxidation of atmospheric compounds under low NO_x conditions.

In more rural settings, the lack of NO_x does not impede oxidation although it changes the distribution of products generated. These pathways are important because they affect HO_x levels which are not well modelled in pristine atmospheric environments. In particular, isomerization pathways (such as hydrogen atom shifts) have been explored recently which may regenerate HO_x and therefore give rise to better agreement with field measurements. Such pathways depend on the chemical structure and degree of oxidation of the precursor hydrocarbon. There is already a large basis of electronic structure calculations that have been conducted to examine low NO_x pathways. In this task, the contractor shall analyze the large dataset of precursor oxidation reactions to prepare the results for publication. In particular, computational methods will be used to determine the relative yields of common gas phase products measured in the laboratory because of the difficulty in obtaining standards to quantify all oxidized compounds in gas chromatography applications. The contractor shall also conduct further calculations using the nudged elastic band (NEB) method to explore new reaction pathways for the series of precursor hydrocarbons determined by the WACOR. Master equation solvers such as MESMER shall be used to determine phenomenological rate constants, branching ratios and product yields.

Task 3. Smog Gas and Aerosol Chamber Sampling.

If requested via written technical by the EPA WACOR, the contractor shall participate in and provide support for laboratory smog chamber experiments. Support shall include maintenance/upkeep of assigned equipment (including the smog chamber, ancillary equipment, and the AMS system), repair/troubleshooting of chamber-related instrumentation as necessary (including gas monitors, flow controllers, thermostated baths, control devices, etc.), procurement of reactants and sampling media (consumables), and synthesis of select reagents (such as N_2O_5, methyl nitrite, etc.). The contractor shall be responsible for AMS sampling as specified via written technical direction, and for collection of filter/denuder samples as needed for offline analyses. Collection of samples may include preparation of denuders or filter media, obtaining blanks and background samples, and solvent extraction operations. The contractor shall perform all necessary calibrations and blank checks in accordance with QA guidelines. The contractor shall insure that all appropriate safety precautions are followed when conducting laboratory experiments. The experimental schedule is expected to include this level of support for approximately 4 dynamic runs and 4 static runs. Each of the chamber experiments will be designed by the NERL WACOR, with the experimental conditions communicated to the contractor through a technical communication during weekly technical meetings. EPA reserves the right to substitute dynamic for static experiments on a one (dynamic) for two (static) basis.

If specified via written technical direction by the EPA WACOR, the contractor shall also use the Aerodyne Aerosol Mass Spectrometer (AMS) to characterize the organic components of chamber

aerosol during controlled irradiations. The EPA WACOR will provide design details and technical references, as needed.

QUALITY ASSURANCE

The work is to be conducted for Tasks 1 and 2 under the Quality Assurance Project Plan (QAPP) for Computational Studies of Atmospheric Chemical Processes Involving Hazardous Compounds and Climate Forcing Agents (QAPP ID: D-EMMD-AQB-005-QAPP-01, September 2016). Computations shall be performed under existing procedures found in the QAPP. Quality Assurance Project Plan - Investigations of Atmospheric Chemical Processes That Control Ambient Concentrations of Ozone, PM2.5, and Air Toxic Compounds (QAPP J15-001.0, August 2015), which covers the investigation of atmospheric chemical processes in a smog chamber, shall be followed for work outlined in Task 3. Standard "good laboratory practices" for maintaining notebooks shall be employed.

DELIVERABLES

1. Biweekly progress meetings shall be held with the WACOR to discuss technical progress and plans to complete the work of the PWS.

2. Output files for all computational chemistry runs (including but not limited to *.out text files from Gaussian 09, MESMER *.test text files) and aminations (*.xtd Materials Studio trajectory files) developed from all reaction systems of interest. Potential energy surface plots (in kcal/mol) should also be provided where all species have been clearly labelled. All animations should be provided to the WACOR in avi-format.

3. A draft manuscript describing results of calculations involving reactions of various precursors under low NO_x conditions shall be prepared for the EPA WACOR to review by March 31st, 2017.

4. Electronic files containing all standard chemical analysis data from the chamber (sample files may be provided by the work assignment COR). The data shall be presented in the form of an Excel spreadsheet. The spreadsheet file will include data for inorganic compounds measured with continuous monitors, reactant hydrocarbons measured by the automated gas chromatography system (if specified in TD by the WACOR), and carbonyl compounds using DNPH. Standard plots of all data in a spreadsheet will be required. These outputs are required within one month of the completion of the experiment. The contractor must immediately notify the EPA WACOR if this schedule cannot be achieved for any experiment and provide the date that the data will be submitted. Following each experiment, a debriefing can be conducted during the weekly meeting to discuss any problems that occurred during the run.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-106

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2016 To 03/31/2017 Base Option Period Number 1	Comput.Chem.Investigations

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: tasks 1-3

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 11/08/2016 To 03/31/2017

Comments:
The purpose of this amendment is to revise the PWS (changes have been highlighted in yellow).

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2016 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Surender Kaushik (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-5691 FAX Number:	
Project Officer Name Robin S. Harris (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-0955 FAX Number:	
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:	
Contracting Official Name Candice Charlton (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2007 FAX Number:	

Performance Work Statement

WA Title: Computational Chemistry Investigations of Reactions Involving Atmospherically Relevant Hydrocarbons with Oxides of Nitrogen

WA #: 1-106 **WACOR:** Surender Kaushik

Contract #: EP-C-15-008 **Alternate WACOR:** Tadeusz Kleindienst

PERIOD OF PERFORMANCE

CO Issuance through March 31, 2017.

SUMMARY OF OBJECTIVES

1. To apply computational chemistry (COMPCHEM) to determine yields, lifetimes and fates of atmospheric compounds under a variety of conditions (oxidant loads, temperature, pressure) in order to improve upon existing chemical mechanisms.
2. To utilize COMPCHEM methods to explore new atmospheric reactions of interest that may be difficult to quantify experimentally.
3. To the extent to which (1) and (2) are successful, use COMPCHEM to improve chemical mechanisms in air quality (AQ) models.
4. Beyond objectives (1) and (2), determine the extent to which COMPCHEM can be used to predict atmospheric lifetimes and fates of compounds that can adversely impact climate change.
5. Beyond objectives (1) and (2), determine the extent to which COMPCHEM can be used to predict atmospheric lifetimes and fates of toxic compounds that can adversely impact human health and/or damage sensitive ecosystems.
6. Conduct chamber and modeling studies of the smog chamber chemistry to improve understanding of the gas-phase chemistry of ozone, nitric acid, air toxics, and SOA formed in reactive hydrocarbon (HC)/NO_x, HC/OH, or HC/NO_3 systems.

BACKGROUND

Toxic compounds may either be emitted or produced in the atmosphere. The production and degradation rates for regulated species such as $PM_{2.5}$, O_3 and NO_x are imprinted upon a complex chemical mechanism that maps the interconversion of all atmospheric constituents. With field measurements, it is extremely difficult to disentangle all relevant reactions because of their sheer number and degree of coupling. In the laboratory, only a small subset of reactions has been studied in relatively 'simplified atmospheres', which are not always adequately representative. Therefore, highly sensitive techniques that are not constrained by detection limits are desired to help unravel atmospheric chemistry.

The highest degree of sensitivity and spatial resolution available to study molecular interactions are afforded by computational chemistry methods. The theoretical foundation of quantum mechanics and advancements in computational power have enabled the detailed study of a wide variety of reactions where interactions may be probed at the chemical bond level with a high level of accuracy. In principle, any reaction may be studied although larger chemical systems warrant either larger computer clusters or more computational time to complete. Computational chemistry is increasingly being applied to explore atmospheric reactions. Common reactions such as OH or O_3 oxidations of hydrocarbons as well as new pathways are being considered to improve our understanding of atmospheric chemical mechanisms. This is particularly important for the development of air quality models because reactions represent the sources and sinks of air pollutants that are being tracked. From a regulatory perspective, it is imperative to improve the accuracy of such models because they are being used to develop control strategies in noncompliant regions in the US. As such, computational chemistry is well poised to make a substantial impact in environmental regulations and policies.

SCOPE AND TECHNICAL APPROACH

Task 1. Computational Chemistry Investigations of chemical processes controlling secondary and tertiary products of hydrocarbon reactions important under high NO_x conditions.

NO_x is a central player in the atmospheric chemistry of urban environments. After the hydroxyl radical has initiated the oxidation of hydrocarbons, NO_x readily reacts with the generated peroxy radicals. The main result of this sequence is the production of two prominent atmospheric pollutants: NO_2 and O_3. However, alternative pathways exist with the major one giving rise to organonitrates that sequester some of the NO_x, at least temporarily. Unfortunately, a range of branching ratios have been measured for this pathway and the properties of this crucial reaction as well as other competing reactions are not well understood. Density functional theory (DFT) calculations have been applied to characterize the potential energy surface (PES) of peroxynitrites derived from isoprene. It was found that the branching ratio that produces organonitrates as well as NO_2 is governed by loose transition states. The dissociated biradical van der Waals (vdw) complex that acts as a reactant for both fragmentation and isomerization pathways exhibits multireference character that may not be captured well with DFT calculations. Consequently, the contractor shall perform higher level computational chemistry calculations on the dissociative reactant and transition states in NO_x reactions. In particular, the contractor shall use coupled-cluster theory (CCSD(T) method), which has shown great promise in treating dynamical electron correlation and is considered to be the 'gold standard' of *ab initio* chemistry. While this is a single-reference method, it can approximate the multi-reference character of biradical vdw complexes. For the isoprene system, the contractor shall conduct ~~206~~ single point CCSD(T) calculations of all stationary and transition states of the potential energy surface derived at the M062x/aug-cc-pVTZ level for two oxidized isoprene nitrite isomers.

Formatted: Highlight

The intensive nature of CCSD(T) calculations warrants the use of computer clusters using software capable of performing electronic structure calculations (such as Gaussian 09, GAMESS, CFOUR etc.). The contractor may perform single point calculations, geometry optimizations, potential energy mapping (nudged elastic band) and vibrational frequency analyses to develop a detailed potential energy surface for new NO_x reactions of interest (for example multi-nitrate formation, aromatic and alkyl nitrates – totaling approximately 30 calculations). Graphic depictions for these reactions using

appropriate visualization software should be provided which may include reaction coordinate and/or vibrational frequency animations. The output of these calculations will be used as input into time-dependent, multiple-well, master equation solvers such as VARIFLEX or MESMER. Solutions to the master equation will be used to predict thermal rate constants and product yields as a function of temperature and pressure. The contractor shall travel to the EPA campus in the Research Triangle Park to present a summary of the results of the calculations in a couple of face-to-face meetings.

Task 2. A computational investigation of the oxidation of atmospheric compounds under low NO_x conditions.

In more rural settings, the lack of NO_x does not impede oxidation although it changes the distribution of products generated. These pathways are important because they affect HO_x levels which are not well modelled in pristine atmospheric environments. In particular, isomerization pathways (such as hydrogen atom shifts) have been explored recently which may regenerate HO_x and therefore give rise to better agreement with field measurements. Such pathways depend on the chemical structure and degree of oxidation of the precursor hydrocarbon. There is already a large basis of electronic structure calculations that have been conducted to examine low NO_x pathways. In this task, the contractor shall analyze the large dataset of precursor oxidation reactions to prepare the results for publication. In particular, computational methods will be used to determine the relative yields of common gas phase products measured in the laboratory because of the difficulty in obtaining standards to quantify all oxidized compounds in gas chromatography applications. The contractor shall also conduct further calculations using the nudged elastic band (NEB) method to explore new reaction pathways for the series of precursor hydrocarbons determined by the WACOR. Master equation solvers such as MESMER shall be used to determine phenomenological rate constants, branching ratios and product yields.

Task 3. Smog Gas and Aerosol Chamber Sampling.

If requested via written technical by the EPA WACOR, the contractor shall participate in and provide support for laboratory smog chamber experiments. Support shall include maintenance/upkeep of assigned equipment (including the smog chamber, ancillary equipment, and the AMS system), repair/troubleshooting of chamber-related instrumentation as necessary (including gas monitors, flow controllers, thermostated baths, control devices, etc.), procurement of reactants and sampling media (consumables), and synthesis of select reagents (such as N_2O_5, methyl nitrite, etc.). The contractor shall be responsible for AMS sampling as specified via written technical direction, and for collection of filter/denuder samples as needed for offline analyses. Collection of samples may include preparation of denuders or filter media, obtaining blanks and background samples, and solvent extraction operations. The contractor shall perform all necessary calibrations and blank checks in accordance with QA guidelines. The contractor shall insure that all appropriate safety precautions are followed when conducting laboratory experiments. The experimental schedule is expected to include this level of support for approximately 4 dynamic runs and 4 static runs. Each of the chamber experiments will be designed by the NERL WACOR, with the experimental conditions communicated to the contractor through a technical communication during weekly technical meetings. EPA reserves the right to substitute dynamic for static experiments on a one (dynamic) for two (static) basis.

If specified via written technical direction by the EPA WACOR, the contractor shall also use the Aerodyne Aerosol Mass Spectrometer (AMS) to characterize the organic components of chamber

aerosol during controlled irradiations. The EPA WACOR will provide design details and technical references, as needed.

QUALITY ASSURANCE

The work is to be conducted for Tasks 1 and 2 under the Quality Assurance Project Plan (QAPP) for Computational Studies of Atmospheric Chemical Processes Involving Hazardous Compounds and Climate Forcing Agents (QAPP ID: D-EMMD-AQB-005-QAPP-01, September 2016). Computations shall be performed under existing procedures found in the QAPP. Quality Assurance Project Plan - Investigations of Atmospheric Chemical Processes That Control Ambient Concentrations of Ozone, PM2.5, and Air Toxic Compounds (QAPP J15-001.0, August 2015), which covers the investigation of atmospheric chemical processes in a smog chamber, shall be followed for work outlined in Task 3. Standard "good laboratory practices" for maintaining notebooks shall be employed.

DELIVERABLES

1. Biweekly progress meetings shall be held with the WACOR to discuss technical progress and plans to complete the work of the PWS.
2. Output files for all computational chemistry runs (including but not limited to *.out text files from Gaussian 09, MESMER *.test text files) and aminations (*.xtd Materials Studio trajectory files) developed from all reaction systems of interest. Potential energy surface plots (in kcal/mol) should also be provided where all species have been clearly labelled. All animations should be provided to the WACOR in avi-format.
3. A draft manuscript describing results of calculations involving reactions of various precursors under low NO_x conditions shall be prepared for the EPA WACOR to review by March 31st, 2017.
4. Electronic files containing all standard chemical analysis data from the chamber (sample files may be provided by the work assignment COR). The data shall be presented in the form of an Excel spreadsheet. The spreadsheet file will include data for inorganic compounds measured with continuous monitors, reactant hydrocarbons measured by the automated gas chromatography system (if specified in TD by the WACOR), and carbonyl compounds using DNPH. Standard plots of all data in a spreadsheet will be required. These outputs are required within one month of the completion of the experiment. The contractor must immediately notify the EPA WACOR if this schedule cannot be achieved for any experiment and provide the date that the data will be submitted. Following each experiment, a debriefing can be conducted during the weekly meeting to discuss any problems that occurred during the run.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-111

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base X Option Period Number	1-111

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 1, 6

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Karen Oliver (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-2337 FAX Number:	
Project Officer Name Robin Baily (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:	
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:	
Contracting Official Name Mark Cranley (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109	

Performance Statement of Work

WA Title: EMMD VOC Laboratory Support - Determination of Volatile Organic Compounds using Canisters and Sorbent Sampling Methodologies

WA Short Title: VOC Lab Support

WA #: 1-111 WACOR: Karen Oliver

Contract #: EP-C-15-008 Alternate WACOR: Don Whitaker

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from April 1, 2016, through March 31, 2017.

SUMMARY OF OBJECTIVES

To provide laboratory and data reduction/analysis support for the NERL EMMD VOC laboratory efforts associated with volatile organic compound (VOCs) analyses. The VOC laboratory is responsible for conducting research using whole air canister methods employing preconcentration/GC-MS techniques and sorbent tube sampling methods employing thermal desorption/GC-MS techniques as detailed in EPA SOPs. This WA also requests electronic shop support for repair and maintenance of VOC laboratory instrumentation as an additional component.

BACKGROUND

The NERL EMMD VOC laboratory provides analytical support and methods development activities for a variety of ORD and OAQPS research efforts. Following are examples of recent and current research activities that require contractor support.

Recent studies in the VOC laboratory have involved collaborations with commercial laboratories, vendors, regional laboratories, ORD laboratories (NRMRL) and OAQPS. The focus of these studies has been diffusive air monitoring at fence-line locations of facilities that emit fugitive and area sources of VOCs. These efforts were in support of OAQPS' fence line monitoring rule for benzene which employs Methods 325A and 325B. A database of over 6000 sample analyses was generated in association with these studies. The data include the results of experiments on sampling uptake rates, storage stability, and comparison of tubes from various vendors as well as numerous other experiments. Contractor support was provided under a previous WA to reduce subsets of these data using Excel spreadsheets and assist in preparing and editing journal articles on the data collected during these studies.

Current research efforts under ACE Task EM 1.5 (which incorporates activities that were previously under Task 135) include optimization of the determination of acrolein and associated VOCs in canisters using modified EPA Compendium Method TO-15 techniques. Contractor support is needed to clean canisters, prepare calibration standards of various gas mixtures in canisters, calibrate instrumentation, analyze canister samples, and process/summarize data. Contractor support is needed to prepare and revise SOPs as necessary and also to prepare summary tables of data generated during the course of the work.

Other current research activities include the use of Carbopack X and other types of diffusive sampling tubes for sampling in indoor and outdoor environments in support of ACE Task EM 1.2 (formerly ACE Task 60) and other studies that are currently in the methods development phase. Contractor support is needed to condition Carbopack X and other types of diffusive sampling tubes for use, prepare calibration tube standards using the exposure chamber, monitor the exposure chamber concentrations using the Entech/GC-FID system, prepare and ship sampling tubes for use in field studies, conduct various research experiments (reverse diffusion, temperature and humidity tests, etc.) for validation of target compounds to be collected on sorbent tubes, and analyze samples collected on tubes using thermal desorption/GC-MS techniques.

Additional background information and SOPs are presented in the following EPA-approved Category III QAPPs that are either current or historical for this WA:

- "ACE Task 135 – Improved Method for Measuring Acrolein,"
- "Collaborative Evaluation of a Low-Cost Volatile Organic Compound Passive Sampling Method and Laboratory Intercomparison," (ACE Task 60) and
- "Philadelphia Passive Sampler Method Study. EPA Region 3 Energy RARE Project", QLOG No. A-18508, QTRAK No. 13010.

SCOPE

The contractor shall provide technical support for the NERL EMMD VOC Laboratory as described in the Background and Technical Approach/Objectives.

TECHNICAL APPROACH/OBJECTIVES

Laboratory Activities

1. During periods of active laboratory analyses, the Contractor shall support on a daily basis and as needed, the preparation of canisters for sample collection, preparation of calibration standards in canisters, preparation of sorbent tubes for sample collection, and the preparation of calibration standards on sorbent tubes. The Contractor also shall support the sample

analysis and data reduction of the monitoring system associated with the canister/tube standards loading system (Entech/GC-FID system). In addition, the Contractor shall support the sample analysis and data reduction of canister and/or sorbent tubes using the EMMD VOC laboratory's PerkinElmer thermal desorption/Agilent GC-MS systems, Entech/GC-MS system, and the new Markes Unity/Almsco GC-TOF system. The Contractor shall maintain spreadsheets tracking sorbent tube usage during field studies and assist with routine maintenance of laboratory instrumentation. Additional information is provided in the following bullets. Laboratory activities are anticipated to occur for approximately 100% of the stated period of performance.

- The Contractor shall prepare approximately five multipoint calibration tube standard sets (with seven levels of 15 tubes per level expected for each set) using the EPA passive sampler exposure chamber and Carbopack X or similar tubes supplied by EPA.

- The Contractor shall operate the EPA Entech VOC Concentrator/GC-FID system in the exposure chamber laboratory to monitor chamber contents during tube exposures. The Contractor shall monitor GC-FID system stability, recalibrate the system as needed, and review and compile the analytical data generated with this system.

- The Contractor shall prepare tubes for shipment to the field based on schedules to be provided by EPA.

- The Contractor shall maintain summary spreadsheets of tubes conditioned, standards prepared, and theoretical and actual concentrations of VOCs in the exposure chamber (referencing actual tube identification numbers as appropriate) and provide summaries of the above activities with the monthly reports. VOCs to be reported for sorbent tube research efforts shall include but is not limited to the following compounds: 1,3-Butadiene, benzene, toluene, ethylbenzene, m-xylene, p-xylene, styrene, o-xylene, tetrachloroethene, and carbon tetrachloride.

2. The Contractor shall assist in the revision of SOPs as needed for laboratory instrumentation and methods. Additionally, the Contractor shall develop SOPs for the new sorbent tube exposure chamber located in laboratory D260, the generation of sorbent tube calibration standards using the active loading system in laboratory D260A, as well as the operation of the Markes thermal desorber/GC-TOF system in the EMMD VOC laboratories. The Contractor shall also provide technical editorial review of the SOPs.

Publication Activities

3. The Contractor shall assist in the development and/or revision of as many as two publications on Carbopack X tube data and data associated with various laboratory experiments. Efforts shall include the evaluation of method validation experiments for VOCs collected diffusively on Carbopack X sorbent tubes. Activities anticipated for this task shall include but are not limited to conducting basic statistical analyses on existing datasets associated with storage stability, uptake rates, sorbent tube lot differences, methods validation experiments, and other experiments. The product will be graphs and tables for reports, publications, and presentations. The Contractor shall also provide technical editorial review of the associated completed documents prepared by EPA. Details of this task component may need further clarification by the WACOR and Alternate WACOR through a technical discussion meeting to answer specific Contractor questions.

Electronic Shop Activities

4. The contractor shall provide electronics shop support for VOC laboratory instrumentation. The WACOR will provide technical direction to the contractor for evaluation of VOC laboratory instrumentation and associated equipment and the contractor shall diagnose and recommend repair options to the WA COR in an email. The WACOR will evaluate the recommendations and provide technical direction on how to repair equipment. The contractor shall repair equipment and purchase any required items needed for the repairs. In addition, the contractor shall purchase items needed for VOC laboratory instrumentation and associated equipment calibration based on technical direction of the WACOR.

QUALITY ASSURANCE

The Contractor shall use the existing EPA-approved Category III QAPPs listed in the SOW Background section above and update the QAPPs as needed. Only minor revisions to the QAPPs are expected such as updating organization charts and staffing lists. The Contractor also shall prepare and revise SOPs for laboratory instrumentation and methods. Some of the specific SOPs to be developed are listed in the Deliverables section below, although additional SOPs may be developed as needed based on technical discussion with the WACOR and/or alternate WACOR.

Calibrations of scientific instruments shall be performed under existing Standard Operating Procedures. Standard "good laboratory practices" for maintaining notebooks shall be employed.

DELIVERABLES AND SCHEDULE

• The Contractor shall prepare an SOP for the generation of sorbent tube calibration standards using the active loading system in laboratory D260A. An initial draft version of the SOP is due on April 30, 2016, and the final version of the SOP is due on June 30, 2016.

• The Contractor shall prepare an SOP for the operation of the new sorbent tube exposure chamber located in laboratory D260. An initial draft version of the SOP is due on May 30, 2016, and the final version of the SOP is due on January 20, 2017.

• The Contractor shall prepare an SOP for the operation of the Markes thermal desorber/GC-TOF system. An initial draft version of the SOP is due on June 30, 2016, and the final version of the SOP is due on December 5, 2016.

• The Contractor shall provide a brief letter report containing the spreadsheets discussed above that were prepared for this project and documenting any additional supporting information on QA results and on any other topic that helps in interpretation of the results. This report is due on March 31, 2017.

STAFFING QUALIFICATIONS

(a) The Contractor staff selected to conduct the laboratory work must have five or more years of experience in each of the following VOC laboratory activities: Handling Carbopack X tubes (conditioning tubes and preparing them for shipment); using the exposure chamber for preparing calibration standards diffusively on Carbopack X tubes; operating the PerkinElmer automated thermal desorption/Agilent GC-MS systems (Turbomatrix ATD and ATD 650) for the determination of VOCs collected on sorbent tube samples; operating Entech VOC concentrators (7100/7200)/Agilent GC-MS systems for the determination of VOCs collected in canisters; and operating VOC preconcentration (Nutech/Entech)/GC-FID (HP/Agilent) systems in the VOC laboratory.

(b) The contractor staff selected to conduct the electronics shop activities must have ten or more years of specialized experience in troubleshooting and repairing complex air monitoring analytical systems including VOC preconcentration systems and canister cleaning systems and fabricating dilution systems with supporting components such as data loggers and humidity/temperature sensors.

(c) Technical writing and editing assistance is needed for developing SOPs, reports, presentations, and journal articles. The contractor staff assigned to this task must

have at least 10 years of experience in documenting laboratory procedures and instrumentation for environmental research.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-111

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2016 Base X Option Period Number	1-111 NERL VOC lab support

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2016 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee — LOE:

Cumulative Approved: — Cost/Fee — LOE:

Work Assignment Manager Name: Karen Oliver (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-2337 FAX Number:	
Project Officer Name: Robin Baily (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:	
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:	
Contracting Official Name: Mark Cranley (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109	

Performance Statement of Work

WA Title: EMMD VOC Laboratory Support - Determination of Volatile Organic Compounds using Canisters and Sorbent Sampling Methodologies

WA Short Title: VOC Lab Support

WA #: 1-111 Amendment

WACOR: Karen Oliver

Contract #: EP-C-15-008

Alternate WACOR: Don Whitaker

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from April 1, 2016, through March 31, 2017.

SUMMARY OF OBJECTIVES

To provide laboratory and data reduction/analysis support for the NERL EMMD VOC laboratory efforts associated with volatile organic compound (VOCs) analyses. The VOC laboratory is responsible for conducting research using whole air canister methods employing preconcentration/GC-MS techniques and sorbent tube sampling methods employing thermal desorption/GC-MS techniques as detailed in EPA SOPs. This WA also requests electronic shop support for repair and maintenance of VOC laboratory instrumentation as an additional component.

This Performance Statement of Work is being amended to add a task to support methods development, laboratory, and data reduction activities for VOCs collected from tire crumb samples onto sorbent tubes such as Carbopack X tubes and Radiello samplers. The text relevant to this amendment is highlighted in yellow.

BACKGROUND

The NERL EMMD VOC laboratory provides analytical support and methods development activities for a variety of ORD and OAQPS research efforts. Following are examples of recent and current research activities that require contractor support.

Recent studies in the VOC laboratory have involved collaborations with commercial laboratories, vendors, regional laboratories, ORD laboratories (NRMRL) and OAQPS. The focus of these studies has been diffusive air monitoring at fence-line locations of facilities that emit fugitive and area sources of VOCs. These efforts were in support of OAQPS' fence line monitoring rule for benzene which employs Methods 325A and 325B. A database of over 6000 sample analyses was generated in association with these studies. The data include the results of experiments on

sampling uptake rates, storage stability, and comparison of tubes from various vendors as well as numerous other experiments. Contractor support was provided under a previous WA to reduce subsets of these data using Excel spreadsheets and assist in preparing and editing journal articles on the data collected during these studies.

Current research efforts under ACE Task EM 1.5 (which incorporates activities that were previously under Task 135) include optimization of the determination of acrolein and associated VOCs in canisters using modified EPA Compendium Method TO-15 techniques. Contractor support is needed to clean canisters, prepare calibration standards of various gas mixtures in canisters, calibrate instrumentation, analyze canister samples, and process/summarize data. Contractor support is needed to prepare and revise SOPs as necessary and also to prepare summary tables of data generated during the course of the work.

Other current research activities include the use of Carbopack X and other types of diffusive sampling tubes for sampling in indoor and outdoor environments in support of ACE Task EM 1.2 (formerly ACE Task 60) and other studies that are currently in the methods development phase. Contractor support is needed to condition Carbopack X and other types of diffusive sampling tubes for use, prepare calibration tube standards using the exposure chamber, monitor the exposure chamber concentrations using the Entech/GC-FID system, prepare and ship sampling tubes for use in field studies, conduct various research experiments (reverse diffusion, temperature and humidity tests, etc.) for validation of target compounds to be collected on sorbent tubes, and analyze samples collected on tubes using thermal desorption/GC-MS techniques.

Additional background information and SOPs are presented in the following EPA-approved Category III QAPPs that are either current or historical for this WA:

- "ACE Task 135 – Improved Method for Measuring Acrolein,"
- "Collaborative Evaluation of a Low-Cost Volatile Organic Compound Passive Sampling Method and Laboratory Intercomparison," (ACE Task 60) and
- "Philadelphia Passive Sampler Method Study. EPA Region 3 Energy RARE Project", QLOG No. A-18508, QTRAK No. 13010.

SCOPE

The contractor shall provide technical support for the NERL EMMD VOC Laboratory as described in the Background and Technical Approach/Objectives.

TECHNICAL APPROACH/OBJECTIVES

Laboratory Activities

1. During periods of active laboratory analyses, the Contractor shall support on a daily basis and as needed, the preparation of canisters for sample collection, preparation of calibration standards in canisters, preparation of sorbent tubes for sample collection, and the preparation of calibration standards on sorbent tubes. The Contractor also shall support the sample analysis and data reduction of the monitoring system associated with the canister/tube standards loading system (Entech/GC-FID system). In addition, the Contractor shall support the sample analysis and data reduction of canister and/or sorbent tubes using the EMMD VOC laboratory's PerkinElmer thermal desorption/Agilent GC-MS systems, Entech/GC-MS system, and the new Markes Unity/Almsco GC-TOF system. The Contractor shall maintain spreadsheets tracking sorbent tube usage during field studies and assist with routine maintenance of laboratory instrumentation. Additional information is provided in the following bullets. Laboratory activities are anticipated to occur for approximately 100% of the stated period of performance.

- The Contractor shall prepare approximately five multipoint calibration tube standard sets (with seven levels of 15 tubes per level expected for each set) using the EPA passive sampler exposure chamber and Carbopack X or similar tubes supplied by EPA.

- The Contractor shall operate the EPA Entech VOC Concentrator/GC-FID system in the exposure chamber laboratory to monitor chamber contents during tube exposures. The Contractor shall monitor GC-FID system stability, recalibrate the system as needed, and review and compile the analytical data generated with this system.

- The Contractor shall prepare tubes for shipment to the field based on schedules to be provided by EPA.

- The Contractor shall maintain summary spreadsheets of tubes conditioned, standards prepared, and theoretical and actual concentrations of VOCs in the exposure chamber (referencing actual tube identification numbers as appropriate) and provide summaries of the above activities with the monthly reports. VOCs to be reported for sorbent tube research efforts shall include but is not limited to the following compounds: 1,3-Butadiene, benzene, toluene, ethylbenzene, m-xylene, p-xylene, styrene, o-xylene, tetrachloroethene, and carbon tetrachloride.

2. The Contractor shall assist in the revision of SOPs as needed for laboratory instrumentation and methods. Additionally, the Contractor shall develop SOPs for the new sorbent tube exposure chamber located in laboratory D260, the generation of sorbent tube calibration standards using the active loading system in laboratory D260A, as well as the operation of the Markes thermal desorber/GC-TOF system in the EMMD VOC laboratories. The Contractor shall also provide technical editorial review of the SOPs.

Publication Activities

3. The Contractor shall assist in the development and/or revision of as many as two publications on Carbopack X tube data and data associated with various laboratory experiments. Efforts shall include the evaluation of method validation experiments for VOCs collected diffusively on Carbopack X sorbent tubes. Activities anticipated for this task shall include but are not limited to conducting basic statistical analyses on existing datasets associated with storage stability, uptake rates, sorbent tube lot differences, methods validation experiments, and other experiments. The product will be graphs and tables for reports, publications, and presentations. The Contractor shall also provide technical editorial review of the associated completed documents prepared by EPA. Details of this task component may need further clarification by the WACOR and Alternate WACOR through a technical discussion meeting to answer specific Contractor questions.

Electronic Shop Activities

4. The contractor shall provide electronics shop support for VOC laboratory instrumentation. The WACOR will provide technical direction to the contractor for evaluation of VOC laboratory instrumentation and associated equipment and the contractor shall diagnose and recommend repair options to the WA COR in an email. The WACOR will evaluate the recommendations and provide technical direction on how to repair equipment. The contractor shall repair equipment and purchase any required items needed for the repairs. In addition, the contractor shall purchase items needed for VOC laboratory instrumentation and associated equipment calibration based on technical direction of the WACOR.

5. During periods of active laboratory analyses, the Contractor shall support on a daily basis and as needed, the conditioning and preparation of sorbent tubes (Carbopack X PerkinElmer sorbent tubes and Carbopack X Radiello samplers) for tire crumb sample collection and the preparation of calibration standards on sorbent tubes. The Contractor also shall support the sample analysis and data reduction of the Entech/GC-FID monitoring system associated with the exposure chamber for tube standards preparation. In addition, the Contractor shall support the sample analysis and data reduction of VOCs collected from tire crumb samples on sorbent tubes using the EMMD VOC laboratory's Markes Unity/Almsco GC-TOF system as well as the PerkinElmer thermal desorption/Agilent GC-MS systems if needed. The Contractor shall maintain spreadsheets tracking sorbent tube usage during tire crumb field studies and assist with routine maintenance of laboratory instrumentation. Additional information is provided in the following bullets. These laboratory activities are anticipated to occur for approximately six months during the stated period of performance.

- The Contractor shall optimize the Markes thermal desorption/TOF system for the analysis of VOCs in tire crumb samples collected on Carbopack X sorbent tubes and Radiello samplers, including optimizing the analytical method parameters and system configuration, the calibration and data reduction activities and reports, and the library search parameters and reports as needed.

- The Contractor shall prepare approximately four multipoint calibration tube standard sets using combinations of the TO14, PAMS, TO-15 subset and TO-15 plus cylinders (with seven levels of 15 tubes per level expected for each set) and the EPA passive sampler exposure chamber and/or the active tube loading system and Carbopack X or similar tubes such as Radiello tubes to be supplied by EPA.

- The Contractor shall prepare approximately four multipoint calibration tube standard sets (with seven levels of 3 tubes per level), using liquid standards as needed if gas standards are unavailable, of 2-methyl-2-propanamine, benzothiazole and similar compounds and the flash standards loading system in the hood in laboratory D260A, the exposure chambers or the active loading system as applicable. An HSRP on Tire Crumb Rubber Studies has been developed to address handling of hazardous materials by VOC laboratory staff and other members of the study team and this document will be provided to the Contractor.

- The Contractor shall operate the EPA Entech VOC Concentrator/GC-FID system in the exposure chamber laboratory to monitor chamber contents during tube exposures. The Contractor shall monitor GC-FID system stability, recalibrate the system as needed, and review and compile the analytical data generated with this system.

- The Contractor shall prepare tubes for delivery to the NRMRL exposure chamber laboratory as well as for shipment to the field based on schedules to be provided by EPA. Appropriate chain of custody procedures will be followed like those previously employed for Regional/RARE studies in the VOC laboratory.

- The Contractor shall maintain summary spreadsheets of tubes conditioned, standards prepared, and theoretical and actual concentrations of VOCs in the exposure chamber or active loading system (referencing actual tube identification numbers as appropriate) and provide summaries of the above activities with the monthly reports. VOCs to be reported for sorbent tube research efforts shall include but are not limited to the compounds on the TO-14 and DEARS compound lists as well as believed to be 2-butene, methyl isobutyl ketone (MIBK), 2-methyl-2-propanamine, and benzothiazole as tentatively identified for tire crumb scoping samples analyzed on the TOF system. Non-targeted VOCs shall be monitored as well using the TOF system and reported as qualitative data only unless standards can be obtained and calibration samples prepared.

- The Contractor shall update the flash loading system SOP to reflect the current configuration of the loading system in D260A. In addition, the contractor shall prepare an SOP on the use of Radiello samplers for collection of VOCs from ambient air samples.

- The Contractor shall provide QA review of data processes, data packages, and data reports for tire crumb research activities.

- The Contractor shall prepare a technical report on the drift correction and background subtraction processes that currently are used in the VOC laboratory calibration and data processing activities.

QUALITY ASSURANCE

The Contractor shall use the existing EPA-approved Category III QAPPs listed in the SOW Background section above and update the QAPPs as needed. Only minor revisions to the QAPPs are expected such as updating organization charts and staffing lists. The Contractor also shall prepare and revise SOPs for laboratory

instrumentation and methods. Some of the specific SOPs to be developed are listed in the Deliverables section below, although additional SOPs may be developed as needed based on technical discussion with the WACOR and/or alternate WACOR. Calibrations of scientific instruments shall be performed under existing Standard Operating Procedures. Standard "good laboratory practices" for maintaining notebooks shall be employed.

For the Tire Crumb research activities, the QAPP "*Quality Assurance Project Plan, Tire Crumb Research Sample Analysis*" is currently being drafted by EPA staff and will be distributed to the Contractor when complete.

DELIVERABLES AND SCHEDULE

• The Contractor shall prepare an SOP for the generation of sorbent tube calibration standards using the active loading system in laboratory D260A. An initial draft version of the SOP is due on April 30, 2016, and the final version of the SOP is due on June 30, 2016.

• The Contractor shall prepare an SOP for the operation of the new sorbent tube exposure chamber located in laboratory D260. An initial draft version of the SOP is due on May 30, 2016, and the final version of the SOP is due on January 20, 2017.

• The Contractor shall prepare an SOP for the operation of the Markes thermal desorber/GC-TOF system. An initial draft version of the SOP is due on June 30, 2016, and the final version of the SOP is due on December 5, 2016.

• The Contractor shall prepare an SOP on the use of Radiello samplers for collection of VOCs in ambient air. An initial draft version of the SOP is due on June 15, 2016, and the final version of the SOP is due on July 15, 2016.

• The Contractor shall prepare an SOP on the flash loading system. An initial draft version of the SOP is due on June 30, 2016, and the final version of the SOP is due on August 31, 2016.

• The Contractor shall prepare a technical report on drift correction and background subtraction processes. An initial draft version of the report is due on August 31, 2016, and the final version of the report is due on September 30, 2016.

• The Contractor shall provide a brief letter report containing the spreadsheets discussed above that were prepared for this project and documenting any additional supporting information on QA results and on any other topic that helps in interpretation of the results. This report is due on March 31, 2017.

STAFFING QUALIFICATIONS

(a) The Contractor staff selected to conduct the laboratory work must have five or more years of experience in each of the following VOC laboratory activities: Handling Carbopack X tubes (conditioning tubes and preparing them for shipment); using the exposure chamber for preparing calibration standards diffusively on Carbopack X tubes; operating the PerkinElmer automated thermal desorption/Agilent GC-MS systems (Turbomatrix ATD and ATD 650) for the determination of VOCs collected on sorbent tube samples; operating Entech VOC concentrators (7100/7200)/Agilent GC-MS systems for the determination of VOCs collected in canisters; and operating VOC preconcentration (Nutech/Entech)/GC-FID (HP/Agilent) systems in the VOC laboratory.

(b) The Contractor staff selected to conduct the electronics shop activities must have ten or more years of specialized experience in troubleshooting and repairing complex air monitoring analytical systems including VOC preconcentration systems and canister cleaning systems and fabricating dilution systems with supporting components such as data loggers and humidity/temperature sensors.

(c) Technical writing and editing assistance is needed for developing SOPs, reports, presentations, and journal articles. The contractor staff assigned to this task must have at least 10 years of experience in documenting laboratory procedures and instrumentation for environmental research.

(d) The Contractor staff selected to conduct the optimization activities for the Markes thermal desorption/Almsco TOF system shall have multiple years of hands on experience with this unique system (Markes TD Autosampler/Unity/CIA Advantage/Agilent 7890 GC/Almsco Bench TOF Select) and a thorough knowledge of the software packages that are installed on the system including an understanding of the underlying programming features of the instrument software and reporting packages.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-111

☐ Other ☒ Amendment Number: 000002

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017
Base Option Period Number 1

Title of Work Assignment/SF Site Name: NERL VOC Lab Spt

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: Section 2 (b)(f)(g) & Section 6 (a)(b)(c)(d)

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:
The purpose of this amendment is to revise the PWS (changes are highlighted in yellow).

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Karen Oliver	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-2337
			FAX Number:
Project Officer Name Robin S. Harris	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-0955
			FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code:
			Phone Number:
			FAX Number:
Contracting Official Name Candice Charlton	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-487-2007
			FAX Number:

Performance Statement of Work

WA Title: EMMD VOC Laboratory Support - Determination of Volatile Organic Compounds using Canisters and Sorbent Sampling Methodologies

WA Short Title: VOC Lab Support

WA #: 1-111 Amendment

WACOR: Karen Oliver

Contract #: EP-C-15-008

Alternate WACOR: Don Whitaker

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from April 1, 2016, through March 31, 2017.

SUMMARY OF OBJECTIVES

To provide laboratory and data reduction/analysis support for the NERL EMMD VOC laboratory efforts associated with volatile organic compound (VOCs) analyses. The VOC laboratory is responsible for conducting research using whole air canister methods employing preconcentration/GC-MS techniques and sorbent tube sampling methods employing thermal desorption/GC-MS techniques as detailed in EPA SOPs. This WA also requests electronic shop support for repair and maintenance of VOC laboratory instrumentation as an additional component.

This Performance Statement of Work is being amended to add additional tasks to support methods development, laboratory, and data reduction activities for VOCs collected from tire crumb samples onto sorbent tubes such as Carbopack X tubes and Radiello samplers as detailed in Task 5 below. The text relevant to this amendment is highlighted in yellow.

BACKGROUND

The NERL EMMD VOC laboratory provides analytical support and methods development activities for a variety of ORD and OAQPS research efforts. Following are examples of recent and current research activities that require contractor support.

Recent studies in the VOC laboratory have involved collaborations with commercial laboratories, vendors, regional laboratories, ORD laboratories (NRMRL) and OAQPS. The focus of these studies has been diffusive air monitoring at fence-line locations of facilities that emit fugitive and area sources of VOCs. These efforts were in support of OAQPS' fence line monitoring rule for benzene which employs Methods 325A and 325B. A database of over 6000 sample analyses was generated in

association with these studies. The data include the results of experiments on sampling uptake rates, storage stability, and comparison of tubes from various vendors as well as numerous other experiments. Contractor support was provided under a previous WA to reduce subsets of these data using Excel spreadsheets and assist in preparing and editing journal articles on the data collected during these studies.

Current research efforts under ACE Task EM 1.5 (which incorporates activities that were previously under Task 135) include optimization of the determination of acrolein and associated VOCs in canisters using modified EPA Compendium Method TO-15 techniques. Contractor support is needed to clean canisters, prepare calibration standards of various gas mixtures in canisters, calibrate instrumentation, analyze canister samples, and process/summarize data. Contractor support is needed to prepare and revise SOPs as necessary and also to prepare summary tables of data generated during the course of the work.

Other current research activities include the use of Carbopack X and other types of diffusive sampling tubes for sampling in indoor and outdoor environments in support of ACE Task EM 1.2 (formerly ACE Task 60) and other studies that are currently in the methods development phase. Contractor support is needed to condition Carbopack X and other types of diffusive sampling tubes for use, prepare calibration tube standards using the exposure chamber, monitor the exposure chamber concentrations using the Entech/GC-FID system, prepare and ship sampling tubes for use in field studies, conduct various research experiments (reverse diffusion, temperature and humidity tests, etc.) for validation of target compounds to be collected on sorbent tubes, and analyze samples collected on tubes using thermal desorption/GC-MS techniques.

Additional background information and SOPs are presented in the following EPA-approved Category III QAPPs that are either current or historical for this WA:

- "ACE Task 135 – Improved Method for Measuring Acrolein,"
- "Collaborative Evaluation of a Low-Cost Volatile Organic Compound Passive Sampling Method and Laboratory Intercomparison," (ACE Task 60) and
- "Philadelphia Passive Sampler Method Study. EPA Region 3 Energy RARE Project", QLOG No. A-18508, QTRAK No. 13010.

SCOPE

The contractor shall provide technical support for the NERL EMMD VOC Laboratory as described in the Background and Technical Approach/Objectives.

TECHNICAL APPROACH/OBJECTIVES

Laboratory Activities

1. During periods of active laboratory analyses, the Contractor shall support on a daily basis and as needed, the preparation of canisters for sample collection, preparation of calibration standards in canisters, preparation of sorbent tubes for sample collection, and the preparation of calibration standards on sorbent tubes. The Contractor also shall support the sample analysis and data reduction of the monitoring system associated with the canister/tube standards loading system (Entech/GC-FID system). In addition, the Contractor shall support the sample analysis and data reduction of canister and/or sorbent tubes using the EMMD VOC laboratory's PerkinElmer thermal desorption/Agilent GC-MS systems, Entech/GC-MS system, and the new Markes Unity/Almsco GC-TOF system. The Contractor shall maintain spreadsheets tracking sorbent tube usage during field studies and assist with routine maintenance of laboratory instrumentation. Additional information is provided in the following bullets. Laboratory activities are anticipated to occur for approximately 100% of the stated period of performance.

- The Contractor shall prepare approximately five multipoint calibration tube standard sets (with seven levels of 15 tubes per level expected for each set) using the EPA passive sampler exposure chamber and Carbopack X or similar tubes supplied by EPA.

- The Contractor shall operate the EPA Entech VOC Concentrator/GC-FID system in the exposure chamber laboratory to monitor chamber contents during tube exposures. The Contractor shall monitor GC-FID system stability, recalibrate the system as needed, and review and compile the analytical data generated with this system.

- The Contractor shall prepare tubes for shipment to the field based on schedules to be provided by EPA.

- The Contractor shall maintain summary spreadsheets of tubes conditioned, standards prepared, and theoretical and actual concentrations of VOCs in the exposure chamber (referencing actual tube identification numbers as appropriate) and provide summaries of the above activities with the monthly reports. VOCs to be reported for sorbent tube research efforts shall include but is not limited to the following compounds: 1,3-Butadiene, benzene, toluene, ethylbenzene, m-xylene, p-xylene, styrene, o-xylene, tetrachloroethene, and carbon tetrachloride.

2. The Contractor shall assist in the revision of SOPs as needed for laboratory instrumentation and methods. Additionally, the Contractor shall develop SOPs for the new sorbent tube exposure chamber located in laboratory D260, the generation of sorbent tube calibration standards using the active loading system in laboratory D260A, as well as the operation of the Markes thermal desorber/GC-TOF system in the EMMD VOC laboratories. The Contractor shall also provide technical editorial review of the SOPs.

Publication Activities

3. The Contractor shall assist in the development and/or revision of as many as two publications on Carbopack X tube data and data associated with various laboratory experiments. Efforts shall include the evaluation of method validation experiments for VOCs collected diffusively on Carbopack X sorbent tubes. Activities anticipated for this task shall include but are not limited to conducting basic statistical analyses on existing datasets associated with storage stability, uptake rates, sorbent tube lot differences, methods validation experiments, and other experiments. The product will be graphs and tables for reports, publications, and presentations. The Contractor shall also provide technical editorial review of the associated completed documents prepared by EPA. Details of this task component may need further clarification by the WACOR and Alternate WACOR through a technical discussion meeting to answer specific Contractor questions.

Electronic Shop Activities

4. The contractor shall provide electronics shop support for VOC laboratory instrumentation. The WACOR will provide technical direction to the contractor for evaluation of VOC laboratory instrumentation and associated equipment and the contractor shall diagnose and recommend repair options to the WA COR in an email. The WACOR will evaluate the recommendations and provide technical direction on how to repair equipment. The contractor shall repair equipment and purchase any required items needed for the repairs. In addition, the contractor shall purchase items needed for VOC laboratory instrumentation and associated equipment calibration based on technical direction of the WACOR.

5. During periods of active laboratory analyses, the Contractor shall support on a daily basis and as needed, the conditioning and preparation of sorbent tubes (Carbopack X PerkinElmer sorbent tubes and Carbopack X Radiello samplers) for tire crumb sample collection and the preparation of calibration standards on sorbent tubes. The Contractor also shall support the sample analysis and data reduction of the Entech/GC-FID monitoring system associated with the exposure chamber for tube standards preparation. In addition, the Contractor shall support the sample analysis and data reduction of VOCs collected from tire crumb samples on sorbent tubes using the EMMD VOC laboratory's Markes Unity/Almsco GC-TOF system as well as the PerkinElmer thermal desorption/Agilent GC-MS systems if needed. The Contractor shall maintain spreadsheets tracking sorbent tube usage during tire crumb field studies and assist with routine maintenance of laboratory instrumentation. Additional information is provided in the following bullets. These laboratory activities are anticipated to occur for approximately six months during the stated period of performance.

- The Contractor shall optimize the Markes thermal desorption/TOF system for the analysis of VOCs in tire crumb samples collected on Carbopack X sorbent tubes and Radiello samplers, including optimizing the analytical method parameters and system configuration, the calibration and data reduction activities and reports, and the library search parameters and reports as needed.

- The Contractor shall prepare approximately four multipoint calibration tube standard sets using combinations of the TO14, PAMS, TO-15 subset and TO-15 plus cylinders (with seven levels of 15 tubes per level expected for each set) and the EPA passive sampler exposure chamber and/or the active tube loading system and Carbopack X or similar tubes such as Radiello tubes to be supplied by EPA.

- The Contractor shall prepare approximately four multipoint calibration tube standard sets (with seven levels of 3 tubes per level), using liquid standards as needed if gas standards are unavailable, of 2-methyl-2-propanamine, benzothiazole and similar compounds and the flash standards loading system in the hood in laboratory D260A, the exposure chambers or the active loading system as applicable. An HSRP on Tire Crumb Rubber Studies has been developed to address handling of hazardous materials by VOC laboratory staff and other members of the study team and this document will be provided to the Contractor.

- The Contractor shall operate the EPA Entech VOC Concentrator/GC-FID system in the exposure chamber laboratory to monitor chamber contents during tube exposures. The Contractor shall monitor GC-FID system stability, recalibrate the system as needed, and review and compile the analytical data generated with this system.

- The Contractor shall prepare tubes for delivery to the NRMRL exposure chamber laboratory as well as for shipment to the field based on schedules to be provided by EPA. Appropriate chain of custody procedures will be followed like those previously employed for Regional/RARE studies in the VOC laboratory.

- The Contractor shall maintain summary spreadsheets of tubes conditioned, standards prepared, and theoretical and actual concentrations of VOCs in the exposure chamber or active loading system (referencing actual tube identification numbers as appropriate) and provide summaries of the above activities with the monthly reports. VOCs to be reported for sorbent tube research efforts shall include but are not limited to the compounds on the TO-14 and DEARS compound lists as well as believed to be 2-butene, methyl isobutyl ketone (MIBK), 2-methyl-2-propanamine, and benzothiazole as tentatively identified for tire crumb scoping samples analyzed on the TOF system. Non-targeted VOCs shall be monitored as well using the TOF system and reported as qualitative data only unless standards can be obtained and calibration samples prepared.

- The Contractor shall update the flash loading system SOP to reflect the current configuration of the loading system in D260A. In addition, the contractor shall prepare an SOP on the use of Radiello samplers for collection of VOCs from ambient air samples.

- The Contractor shall provide QA review of data processes, data packages, and data reports for tire crumb research activities.

- The Contractor shall prepare a technical report on the drift correction and background subtraction processes that currently are used in the VOC laboratory calibration and data processing activities.

- The Contractor shall continue to analyze the backlog of ~375 VOC samples collected on Carbopack X tubes by NRMRL staff who are operating the chambers for the characterization phase of the tire crumb research study. Progress on sample analyses in our VOC laboratory has been slowed considerably by the need to run blank tubes after every sample in the early analysis sequences to assess carryover of target compounds such as benzothiazole. In addition, the issues of continuing instability of the TD/GC-

MS TOF internal standards has required that numerous troubleshooting activities be conducted to understand and resolve this issue.

- The Contractor shall review and implement as appropriate the TOF-DS 2.0 software revisions for the Markes Thermal Desorption/GC-TOF MS system which includes enhanced data reduction and data reporting for targeted and non-targeted analytes.

- The Contractor shall perform conditioning and blanking activities for 100 new Carbopack X sorbent tubes that have been purchased for the exposure phase of the tire crumb research study. This will involve bringing the TurboMatrix ATD and/or the ATD 650 thermal desorption GC-MS systems back into operation for analysis of VOCs collected on Carbopack X sorbent tubes, including all necessary system optimization and calibration activities.

- The Contractor shall analyze VOC samples collected on Carbopack X sorbent tubes for the exposure phase of the tire crumb research study along with the associated QC samples which include laboratory blanks and daily check standards. The number of samples to be analyzed is expected to be 100.

QUALITY ASSURANCE

The Contractor shall use the existing EPA-approved Category III QAPPs listed in the SOW Background section above and update the QAPPs as needed. Only minor revisions to the QAPPs are expected such as updating organization charts and staffing lists. The Contractor also shall prepare and revise SOPs for laboratory instrumentation and methods. Some of the specific SOPs to be developed are listed in the Deliverables section below, although additional SOPs may be developed as needed based on technical discussion with the WACOR and/or alternate WACOR. Calibrations of scientific instruments shall be performed under existing Standard Operating Procedures. Standard "good laboratory practices" for maintaining notebooks shall be employed.

For the Tire Crumb research activities, the QAPP "*Quality Assurance Project Plan, Tire Crumb Research Sample Analysis*" is currently being drafted by EPA staff and will be distributed to the Contractor when complete.

DELIVERABLES AND SCHEDULE

- The Contractor shall prepare an SOP for the generation of sorbent tube calibration standards using the active loading system in laboratory D260A. An initial draft version of the SOP is due on April 30, 2016, and the final version of the SOP is due on June 30, 2016.

• The Contractor shall prepare an SOP for the operation of the new sorbent tube exposure chamber located in laboratory D260. An initial draft version of the SOP is due on May 30, 2016, and the final version of the SOP is due on January 20, 2017.

• The Contractor shall prepare an SOP for the operation of the Markes thermal desorber/GC-TOF system. An initial draft version of the SOP is due on June 30, 2016, and the final version of the SOP is due on December 5, 2016.

• The Contractor shall prepare an SOP on the use of Radiello samplers for collection of VOCs in ambient air. An initial draft version of the SOP is due on June 15, 2016, and the final version of the SOP is due on July 15, 2016.

• The Contractor shall prepare an SOP on the flash loading system. An initial draft version of the SOP is due on June 30, 2016, and the final version of the SOP is due on August 31, 2016.

• The Contractor shall prepare a technical report on drift correction and background subtraction processes. An initial draft version of the report is due on August 31, 2016, and the final version of the report is due on September 30, 2016.

• The Contractor shall provide a brief letter report containing the spreadsheets discussed above that were prepared for this project and documenting any additional supporting information on QA results and on any other topic that helps in interpretation of the results. This report is due on March 31, 2017.

STAFFING QUALIFICATIONS

(a) The Contractor staff selected to conduct the laboratory work must have five or more years of experience in each of the following VOC laboratory activities: Handling Carbopack X tubes (conditioning tubes and preparing them for shipment); using the exposure chamber for preparing calibration standards diffusively on Carbopack X tubes; operating the PerkinElmer automated thermal desorption/Agilent GC-MS systems (Turbomatrix ATD and ATD 650) for the determination of VOCs collected on sorbent tube samples; operating Entech VOC concentrators (7100/7200)/Agilent GC-MS systems for the determination of VOCs collected in canisters; and operating VOC preconcentration (Nutech/Entech)/GC-FID (HP/Agilent) systems in the VOC laboratory.

(b) The Contractor staff selected to conduct the electronics shop activities must have ten or more years of specialized experience in troubleshooting and repairing complex air monitoring analytical systems including VOC preconcentration systems and canister cleaning systems and fabricating dilution systems with supporting components such as data loggers and humidity/temperature sensors.

(c) Technical writing and editing assistance is needed for developing SOPs, reports, presentations, and journal articles. The contractor staff assigned to this task must

have at least 10 years of experience in documenting laboratory procedures and instrumentation for environmental research.

(d) The Contractor staff selected to conduct the optimization activities for the Markes thermal desorption/Almsco TOF system shall have multiple years of hands on experience with this unique system (Markes TD Autosampler/Unity/CIA Advantage/Agilent 7890 GC/Almsco Bench TOF Select) and a thorough knowledge of the software packages that are installed on the system including an understanding of the underlying programming features of the instrument software and reporting packages.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-112

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Karen Oliver	(Signature)	(Date)	Branch/Mail Code:
		Phone Number: 919-541-2337
		FAX Number:
Project Officer Name Robin Baily	(Signature)	(Date)	Branch/Mail Code:
		Phone Number: 919-541-7906
		FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code:
		Phone Number:
		FAX Number:
Contracting Official Name Mark Cranley	(Signature)	(Date)	Branch/Mail Code:
		Phone Number: 513-487-2351
		FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Updates and Modifications to Methods used for Determining Toxic Organic Compounds in Ambient Air

WA Short Title: TO Method Updates

WA #: 1-112 WACOR: Karen Oliver

Contract #: EP-C-15-008 Alternate WACOR: Don Whitaker

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the April 1, 2016, through March 31, 2017.

SUMMARY OF OBJECTIVES

As technology evolves and advancements are made in air toxics research, it is imperative that these new technologies and advancements be incorporated into the methods used by the air toxics monitoring community. No significant changes or updates have been made to the air toxics methods (TO Methods) since 1999. Consequently, these methods have become outdated. This work assignment will provide support to EPA staff in updating selected TO methods. During this period of performance, Methods TO-15 and TO-11A will be targeted for updating. Please note that these methods are the primary targets; however, other methods may be identified if resources allow. An EPA workgroup consisting of members from the Office of the Science Adviser (OSA), the Office of Air Quality Planning and Standards (OAQPS), and the Office of Research and Development (ORD) is responsible for establishing the priority of methods to be updated as well as the process by which EPA will solicit ideas and suggestions for changes from members of the air toxics monitoring community. ORD will also be responsible for research to support the proposed changes.

Contractor assistance is needed in the following areas: (1) support for the implementation and documentation of the process by which proposed TO method updates are to be submitted and evaluated, (2) technical review, compilation, and evaluation of submissions received by EPA for consideration in updating the TO methods, (3) technical support related to the laboratory operation, performance, and quality assurance of proposed methods or method updates as well as research on new measurement technologies, and (4) technical editing and assistance in preparing the final draft updates of the methods.

BACKGROUND

The current methods used for measuring air toxics (e.g. volatile organic chemicals, aldehydes and ketones, PAHs, metals) are presented in the Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air—Second Edition (625/R-96/010b, January 1999). The methods were originally prepared and published in June of 1988 by William T. Winberry, Jr., and Norma T. Murphy of Engineering-Science and R. M. Riggan of Battelle-Columbus Laboratories under contract to the EPA. These first "TO Methods," as they are frequently referred to, consisted of guidance in the form of fourteen performance based methods for measuring various air toxics in ambient air. The 1988 compendium was prepared in response to comments generated by an earlier technical assistance document that was prepared by EPA and published in 1983 (EPA-600/4-83-027). In order to produce the compendium publication, the authors consulted with scientists both within and outside the Agency to compile the processes of the time that were being used for measuring selected air toxics in ambient air. Two years later (1990) a hardbound copy of the methods was published as Methods for Determination of Toxic Organic Compounds in Air. This represented the state-of-the-science in 1990 and was a compilation of methods designed to provide guidance to regional, state, and local environmental regulatory agencies as well as industry on the determination of selected toxic organic compounds in ambient air. The guidance provided specific sampling and analysis procedures in a standardized format for selected toxic organic compounds.

In 1999, the National Risk Management Research Laboratory (NRMRL) contracted with Eastern Research Group (ERG) who in turn subcontracted with Midwest Research Institute (MRI) to publish the Compendium of Methods for the Determination of Toxic Organic Compounds in Ambient Air—Second Edition (625/R-96/010b, January 1999). This update contains seventeen peer reviewed performance based methods for the determination of volatile, semi-volatile, and selected toxic organic pollutants in ambient air. The intent of this update, as with the original, was to "assist Federal, State, and local regulatory personnel in developing and maintaining necessary expertise and up-to-date monitoring technology for characterizing organic pollutants in the ambient air." The updated methods were compiled from the best elements of methods used by various organizations and were not intended to be associated with specific regulatory purposes but instead were intended to provide technical support, guidance, and information transfer. While never intended to be anything other than guidance, many of these methods have been referenced by laboratories outside the Agency as EPA sanctioned methods.

These guidance methods last updated in 1999 are currently used by laboratories that provide data to EPA for the National Air Toxics Trends Station (NATTS) Network, the Urban Air Toxics Monitoring Program (UATMP), and the Community-Scale Air Toxics Ambient Monitoring Program (CSATAM). Air toxics measurement data generated from these methods are also incorporated in EPA's National Air

Toxics Assessments (NATA) and used for determining health risks. These programs generally rely on Compendium Methods TO-15 (VOCs by canister), TO-11A (carbonyls by DNPH cartridges), and TO-13A (PAHs).

EPA's Air, Climate, and Energy (ACE) Program has recently approved Task EM-1.5 titled Evaluation, Updates, and Modification to the TO Methods for Volatile Organic Compounds (VOCs). This task (1) authorizes the establishment of a systematic process to identify and prioritize methods for updating; (2) establishes a formal methods workgroup consisting of members from OSA, OAQPS, and ORD charged with reviewing the literature, identifying needed refinements, soliciting input from the air toxics monitoring community, and advising ORD researchers; (3) authorizes ORD technical staff to conduct necessary research to update methods; and (4) requires the preparation of updated draft TO Methods and peer review before final approval and general distribution.

The method updating process as developed by the workgroup requires that EPA review the method to be updated, highlight EPA's proposed changes, and through a webinar or similar vehicle, notify the user community of the intended changes. Additional comments/changes will be solicited from the user community. These comments/changes subsequently will be compiled and reviewed. Appropriate comments/changes will be researched and incorporated or declined. When necessary, laboratory research will be conducted. A draft update of the method will be written and submitted for peer review. Once accepted by peer review, the method will be considered final and the method will be distributed for use.

SCOPE

This work assignment will provide contractor support to EPA to facilitate updates and changes associated with the toxic organic methods known as the TO Methods. EPA has been authorized under ACE Task EM-1.5 to begin updating outdated TO methods last published in 1999. Activities will include assisting in the updates for methods TO-15 and TO-11A. Associated activities may also be conducted to begin preparations for other method updates such as converting existing documents to Word editable format and soliciting proposed ideas for future method updates from the user community. The contractor shall provide support for the following TO Method update program activities.

(1) Assistance in the development, implementation, and documentation of the process outlined by the EPA workgroup by which proposed TO method changes and updates will be conducted.

(2) Assistance with the solicitation of information from the air toxics monitoring community, technical review, and compilation of submitted information received by EPA for consideration in updating the TO methods. This shall include the conversion of existing TO

method documents into Word editable format and assistance with the development of questions and materials necessary for soliciting input with the community solicitation for distribution to the targeted air toxics monitoring community. EPA will provide the contact information for the target community.

(3) Laboratory support for the evaluation of proposed method updates and research on new measurement technologies.

In order to conduct these TO Method Update Program activities, EPA requires technical, administrative, and laboratory support on an ongoing basis. The required technical and administrative support activities are listed below under "Technical Approach/Objectives."

TECHNICAL APPROACH/OBJECTIVES

Task 1. TO Method Update Administrative Support Activities

a. The contractor shall support the EPA TO Methods Update program in establishing, documenting, and implementing the update process developed by the EPA workgroup outlined in the last paragraph of the above section titled "Background." The contractor shall convert current TO methods to Word editable format and develop questions and materials necessary for soliciting input from the air toxics monitoring community. EPA will provide the necessary contact information for distribution of the materials.

b. The contractor shall assist with the solicitation of information from the air toxics monitoring community, compile the submitted information and provide technical editorial review for EPA to use in consideration of method updates.

c. The contractor shall provide technical editing and graphics support (if applicable) for work performed under this work assignment, as may be necessary or incidental.

Task 2. TO Method Update Laboratory Support Activities

The contractor shall provide laboratory support for the evaluation of proposed method updates as well as research on new measurement technologies. The exact nature and scope of the laboratory research is not known at this time as it is to a large extent dependent on the comments received from the air monitoring community. However, for the purposes of costing this WA, the WA COR anticipates laboratory activities will occur for approximately 20% of the stated period of performance. Support under this task shall include editorial staff support as well as

laboratory staff support to assist with development of any necessary Quality Assurance Project Plans (QAPPs) and Standard Operating Procedures (SOPs) that are not currently available from the WA COR. A minimal amount of electronics shop staff support is also requested to facilitate instrument troubleshooting and repair as well as certification activities for the laboratory.

QUALITY ASSURANCE

Standard "good laboratory practices" for maintaining notebooks shall be employed.

As this WA progresses and evaluation and development of measurement methods or research on new measurement technologies begins to become a priority of the WA, the contractor shall assist with the development of QAPPs and related SOPs that address the pertinent needs of each particular project. The WA COR will relay specifics of QAPP development by technical directive as these specifics are not known at this time and will be dependent on the comments that are received from the air monitoring community.

DELIVERABLES AND SCHEDULE

- The Contractor shall compile and prepare a written summary of comments and proposed changes derived from the air toxics monitoring community meeting. This summary is due on June 15, 2016.

- The Contractor shall prepare a document outlining the update process which shall include input from the WA COR, alternate WA COR and members of the EPA Workgroup. This document is due on September 16, 2016.

- The Contractor shall provide an edited draft version of the TO-15 method incorporating the solicited comments from the air toxics monitoring community meeting and the decisions on updates to the method made by the EPA work group members. This draft is due on November 15, 2016.

- The Contractor shall prepare Word editable versions of current methods TO-15, TO-11A, TO-17, TO-4A, TO-13A, and TO-16. These documents are due on March 31, 2017.

- The Contractor shall prepare a brief letter report detailing the activities that were conducted/completed during the period of performance. This report is due on March 31, 2017.

STAFFING QUALIFICATIONS

The contractor staff selected for this WA must have experience in the following areas:

Working knowledge of EPA TO Compendium methods and procedures such as but not limited to the following: Method TO14, Method TO15, and Method TO17 for air samples collected in canisters or on sorbent tubes.

Working knowledge of GC, GC-MS, and GC-TOF instrumentation, thermal desorption and VOC concentration instrumentation from various vendors to facilitate the review and validation of comments submitted by the monitoring community.

Ability to provide relevant feedback (this will require the expertise mentioned in the items above) and technical writing and editorial support for the development of the documentation of the process by which TO Methods are being updated or new TO methods are being developed by EPA. The technical writer/editor must have at least 8 years of experience in documenting laboratory procedures and instrumentation for environmental research.

In addition, the contractor staff selected to conduct the electronics shop activities must have ten or more years of specialized experience in troubleshooting and repairing complex air monitoring analytical systems including VOC preconcentration systems and canister cleaning systems and fabricating dilution systems with supporting components such as data loggers and humidity/temperature sensors.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-113

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base X Option Period Number	1-113

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 1, 6

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Michael Lewandowski	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-9421 FAX Number:
Project Officer Name Robin Baily	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Mark Cranley	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

Performance Statement of Work

Full WA Title: Investigations of Atmospheric Chemistry Processes that Control Ambient Concentrations of Ozone, $PM_{2.5}$, and Air Toxic Compounds.

Short WA Title: Smog Chamber Studies of Atmospheric Chemistry

WA #: 113
Contract #: EP-C-15-008

WACOR: Michael Lewandowski
Alternate WACOR: Tad Kleindienst

PERIOD OF PERFORMANCE
The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

1. Participate in smog chamber experiments designed to generate secondary inorganic aerosol and secondary organic aerosol (SOA), in order to identify and determine the concentrations of SOA compounds of individual atmospherically relevant hydrocarbons and mixtures of hydrocarbons. The focus of these present set of experiments will be on determining SOA parameters from hydrocarbons that may be of importance in SOA formation, particularly in urban airsheds, under both neutral and acidic conditions. Provide laboratory data and analysis of SOA products from the oxidation of these precursor hydrocarbons, and write up data reports and/or journal articles.

2. Measure concentrations of gas and aerosol phase multi-functional polar compounds and high molecular weight organic compounds in ambient and laboratory samples using derivatization, advanced gas and liquid chromatography - mass spectrometry, and AMS methods.

3. Conduct chamber and modeling studies of the smog chamber chemistry to improve understanding of the gas-phase chemistry of ozone, nitric acid, air toxics, and SOA formed in reactive HC/NO_X, HC/OH, or HC/NO_3 systems.

4. Conduct analytical measurements on samples collected at study sites designated by EPA.

5. Provide support for conducting measurements of aerosol optical thickness from organic carbon formed from chemical reactions for parameters important in radiative forcing considerations related to global climate.

BACKGROUND

An understanding of chemical mechanisms is required to develop strategies for controlling ambient $PM_{2.5}$, O_3 and air toxic compounds. Carefully controlled smog chamber experiments, where hydrocarbons are irradiated in the presence of an oxidant (NO_X, H_2O_2 to produce OH radicals in the absence of NO_X, or N_2O_5 as an NO_3 radical source) and secondary gas and aerosol species are measured, provide critical chemical data needed to develop and

evaluate gas and aerosol chemical mechanisms. Smog chamber experiments also provide data for improving air quality modeling O_3, SOA, and secondary air toxic carbonyl compounds (e.g., HCHO, CH_3CHO, or CH_2=CHCHO). Atmospheric chemistry studies will be conducted using a "one-atmosphere" approach and where gas and aerosol parameters are determined simultaneously during an experiment. In cases where the chemical mechanism is too complex, experiments are conducted to parameterize an effect as a function of a measurable quantity (e.g., SOA yield as function of reacted hydrocarbon or mass of organic aerosol mass).

During the previous contract, EP-D-10-070, the EPA-NERL-HEASD on-site contractor carried out smog chamber experiments to determine the importance of SOA compounds from specific HC/oxidant mixtures. Comprehensive organic analysis of the chamber effluent and $PM_{2.5}$ samples was required. The smog chamber samples were analyzed for organic and inorganic composition, with special emphasis placed on the analyses of multi-functional polar organic compounds serving as tracer compounds representative of SOA formation. Laboratory-based mass fractions for SOA were then applied to field study samples to estimate the contribution of SOA from anthropogenic and biogenic precursors. Most recently, mass fraction factors were determined from naphthalene, methylnaphthalenes, and 2-methyl-3-buten-2-ol (MBO).

SCOPE

In this contract period, the contractor shall extend these SOA experiments to provide critical data needed by EPA to assess the impact of SOA from reactions of NO_X, OH, and NO_3 under more extensive conditions. This will include samples from both laboratory experiments and field campaigns. The contractor shall participate in smog chamber experiments designed by EPA to evaluate air quality and climate effects (e.g., aerosol optical depth) from OH initiated reactions with selected hydrocarbons. Experiments will also be designed to study the effect of photochemical mixtures generated from single hydrocarbons or complex sources irradiated in the smog chamber in E 180-M or in the Mobile Chamber system.

TASKS

Task 1. Smog Chamber Investigation

The contractor shall participate in and provide support for laboratory smog chamber experiments. Support shall include maintenance/upkeep of assigned equipment (including the GC-MS system, AMS system, and other chamber-related equipment), repair/troubleshooting of chamber-related instrumentation as needed (including gas monitors, flow controllers, thermostated baths, control devices, etc.), procurement of reactants and sampling media, and synthesis of select reagents (such as N_2O_5, methyl nitrite, etc.). The contractor shall be responsible for AMS sampling as directed, and for collection of filter/denuder samples as needed for offline analyses. Collection of samples may include preparation of denuders or filter media, obtaining blanks and background samples, and solvent extraction

operations. The contractor shall perform all necessary calibrations and blank checks in accordance with QA guidelines. The contractor shall insure that all appropriate safety precautions are followed when conducting laboratory experiments. The experimental schedule is expected to include this level of support for approximately 25 dynamic runs and 20 static runs. Each of the chamber experiments will be designed by the NERL WACOR, with the experimental conditions communicated to the contractor through a technical communication during weekly technical meetings. EPA reserves the right to substitute dynamic for static experiments on a one (dynamic) for two (static) basis.

Task 2. Smog Chamber Samples: Advanced Organic Analyses
The contractor shall analyze by mass spectroscopic methods filter or denuder extracts generated from Task 1 experiments. The contractor shall extract denuder or filter samples for each experiment and analyze them for their organic contents according to previously established SOPs. After derivatization by using the O-(2,3,4,5,6,-pentafluorobenzyl)-hydroxylamine (PFBHA) method, the bis-trimethylsilyl-trifluoroacetamide (BSTFA) method, and the boron trifluoride (BF_3) method, or combinations of these techniques, the contractor shall analyze each sample using gas chromatography mass spectroscopy (GC-MS) along with a set of standards that have been approved by EPA. The contractor shall provide interpretation and, where applicable, quantification of the collected MS data.

The contractor shall also analyze, as required, aerosol samples collected in the laboratory for their peroxide content using a derivatization and UV-visible spectroscopic technique. The contractor shall also make measurements of the N_2O_5 concentrations using an NO titration technique using a line-heated zone together with a standard NO_X analyzer.

The contractor shall use the Aerosol Mass Spectrometer to characterize the inorganic and organic components of chamber aerosol during controlled irradiations, as well as performing aerosol thermal property analysis using varied inlet temperatures. The EPA WA COR will provide design details and technical references, as needed.

Task 3. Analysis of $PM_{2.5}$ Field Samples
In the summer of 2013, EPA participated in the Secondary Organic Aerosol Study (SOAS) at a site in the southeastern US (Centreville, AL) and on the EPA RTP campus (AIRS site). The contractor shall complete the analysis of samples and data collected during these studies, including analysis of filter samples by GC-MS and analysis of collected AMS data. The contractor shall provide analysis and interpretation of secondary tracers from analyzed SOAS field study samples in combination with optical analyses to be performed by EPA staff. Reporting of data to appropriate SOAS-specific databases will be required. Extraction and detailed organic analysis of additional filter samples collected in other applicable field sampling locations may also be performed, time permitting.

WA SPECIFIC EQUIPMENT

Research performed under this Work Assignment will make use of existing EPA smog chambers, GC-MS instrumentation, and AMS instrumentation. These instruments are considered shared equipment, and will be operated and maintained by the contractor. It is not expected that the contractor will be required to procure new instrumentation as part of this work assignment.

QUALITY ASSURANCE

The work is to be conducted under the Quality Assurance Project Plan for Investigations of Atmospheric Chemical Processes that Control Ambient Concentrations of Ozone, $PM_{2.5}$, and Air Toxic Compounds (QAPP-J15-001.0, Dated: 08/2015) updated and approved under contract EP-C-15-008 during the base period. If the development of new methods or analytical procedures is deemed necessary, appropriate SOPs will be generated and the QAPP amended as needed. Calibrations of scientific instruments shall be performed under existing Standard Operating Procedures found in the QAPP. Standard "good laboratory practices" for maintaining notebooks shall be employed by all staff.

DELIVERABLES

1) Weekly progress meetings shall be held with the WACOR to discuss technical progress during the week and specific experiments for the following week.

2) Electronic files shall be provided containing all standard chemical analysis data from the chamber. The data will be presented in Excel spreadsheet, where applicable. The spreadsheet files will include data from, for example, analysis of compounds on filter samples. Plots of all relevant data shall be provided. These outputs are required within 2 weeks of the completion of each experiment. The contractor must immediately notify EPA if this schedule cannot be achieved for any experiment and provide the date that the data will be submitted. Following each experiment, a debriefing can be conducted during the weekly meeting to discuss any problems that occurred during the run.

3) Electronic files containing all GC-MS data for each smog chamber experiment or field sample. These files should include both raw GC data files and any appropriate worksheets that incorporate integration, quantification, and calibrations for specific compounds of interest. These outputs are required within 6 weeks of when the samples were submitted to the contractor. The contractor must immediately notify EPA if this schedule cannot be achieved for any experiment and provide the date that the data will be submitted.

4) Each set of electronic files is a final document and shall contain (a) field/laboratory conditions, (b) a description of analytical methods and models employed, (c) raw data including chromatograms and GC-MS

spectra, (d) concentrations for all compounds and a description of how the concentrations were calculated, (e) all QA/QC data of sufficient detail, as required for an external audit that may occur at a future date.

5) All data generated from field samples shall be provided for review and formatted for submission to study-related databases in appropriate formats (i.e., ICART format).

6) If new analytical methods or analytical procedures are developed in the course of the work, proper SOPs will be generated within 2 weeks, and QAPP updates (if necessary) within one month of the changes.

7) A draft manuscript describing AMS results addressing composition-driven volatility of chamber-generated secondary organic aerosols shall be submitted to EPA for review by June 15th, 2016. Formatted source data from this manuscript shall also be provided in accordance with EPA QA requirements.

STAFFING REQUIREMENTS

Government analysis of labor mix required to conduct the research under this work assignment: 0.75 FTE physical scientist with expertise in GC/ITMS analysis and analytical procedures for the work up of filter extracts for organic tracer analysis; 0.75 FTE physical scientist to operate the AMS and conduct data analysis for the instrument; 0.75 FTE general technical support and maintenance.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-114

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base X Option Period Number	1-114 Air Monitoring Methods..

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 2., 6

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Russell Long	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7744 FAX Number:
Project Officer Name Robin Baily	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:
Other Agency Official Name	(Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Mark Cranley	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

Performance Work Statement

WA Title: Ambient Air Monitoring Methods Assessment and Development for Criteria Gas National Ambient Air Quality Standards

WA #: 1-114 **WACOR:** Russell W. Long

Contract #: EP-C-15-008 **Alternate WACOR:** Rachelle Duvall

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

The National Exposure Research Laboratory, by agreements with the Office of Air Quality Planning and Standards, provides assessment, research and development of air monitoring methods in connection with existing or new national ambient air quality standards (NAAQS) for the Criteria gas pollutants of ozone (O3), nitrogen dioxide (NO2), sulfur dioxide (SO2), and carbon monoxide (CO). This research results in the development of federal reference methods (FRM) which are subsequently used to monitor compliance with the corresponding NAAQS. These reference methods are also routinely used for evaluation of federal equivalent methods (FEMs), and as such, there is a need to assess, revise and/or update these reference and/or equivalent methods to meet the current and future NAAQS requirements. There is an additional need for research in the development of new FRMs for newly proposed primary and secondary NAAQS.

BACKGROUND

The NAAQS monitoring regulations require that state, local and Tribal air monitoring agencies must use only EPA-designated reference or equivalent methods in their ambient air monitoring networks to determine compliance with the criteria gas NAAQS. The current reference method, listed in Appendix to 40CFR50, for monitoring NO2 is more than three decades old and contains a known measurement interference. For SO2, the FRM has recently been updated however, there is significant uncertainty regarding the applicability of the new FRM under low or background concentration conditions such as those that might be experienced in the proposed SOx-NOx secondary NAAQS monitoring pilot study network. There is also a need to evaluate and develop a new reference method for the NOy indicator of the proposed SOx-NOx secondary NAAQS. These reference methods also serve as a basis for evaluation of federal equivalent methods (FEMs) for US EPA designation and for evaluating new low cost sensor technology for ambient pollution monitoring.

SCOPE

By agreement with OAQPS, NERL provides the necessary research for the assessment and development of reference and equivalent methods for ambient air monitoring coincident with the establishment of new or revised NAAQS. The Air Quality Branch is currently responsible for administering the Reference and Equivalent Methods program and managing/coordinating the efforts of evaluating, reviewing and revising and/or updating these reference and equivalent methods. Research and technical support is needed in evaluating, revision and/or update of the current FRMs and assessment of current and future FEMs and other (small sensor, remote sensing) measurement techniques.

TECHNICAL APROACH/OBJECTIVES

Task 1. Technical review of NO2, NOy and other gas phase criteria pollutant methods. The contractor shall perform review of the current gas phase reference methods, listed in Appendices to 40 CFR 50, to determine whether the specified method (a) is still appropriate and widely in use, (b) is based on the modern technology, and (c) will meet the current and anticipated future NAAQS requirements, including use in secondary NAAQS monitoring networks. The contractor shall also perform review of the novel methodology for the determination of O3, "true" NO2 and other gas phase criteria pollutants in ambient air. As needed, the contractor will perform the appropriate literature search, review existing publications and reports, discuss with expert scientists in that field, and contact the instrument manufacturers. Based on the technical review findings, the contractor will provide a summary of the status of the current FRM and make recommendations regarding revision and/or update of the current reference method. The WA COR will assign priority to the methods to be reviewed and will issue technical directive to the contractor that will identify the material to be evaluated, specify the approach and protocols for the review, and identify the target date by which the deliverable(s) are to be provided to the WA COR.

Task 2. Revision or Update of NO2, and other gas phase criteria pollutant Reference Methods and Development of New FRMs - Based upon technical directive from the WACOR, the contractor will prepare necessary materials to be included in proposed and final rulemaking packets to be published in the Code of Federal Register. During this process, the contractor will review both Parts 50 and 53 of the 40 CFR and ensure consistency in language and technical requirements. This effort will be coordinated with OAQPS. The technical directive will identify the requirements for the revision and/or update of the FRM, specify the protocols, and identify the target date by which the deliverable(s) are to be provided to the WA COR. Any materials identified as CBI shall be treated in accordance with CBI regulations and policy restrictions.

Task 3. Laboratory and ambient assessment and data analysis of NO2, NOy, O3 and other criteria pollutant methods for use as primary and secondary NAAQS FRMs/FEMs. The contractor shall conduct laboratory and ambient based research activities, as appropriate or necessary, related to the assessment and development of new reference and equivalent methods for NO2, NOy, O3, and other criteria pollutants. The research may include investigation of novel measurement technologies associated with the individual NAAQS criteria pollutants and the applicability of these methods to the routine monitoring for NAAQS compliance, resolution of potential measurement uncertainties, interferences, or other technical problems associated with samplers, analyzers, measurement principles or techniques. This work may be performed both in a laboratory setting under controlled conditions and during ambient studies. The contractor support shall include, but is not limited to site, laboratory, and instrument set-up; instrument calibration; instrument maintenance (through the electronics shop); daily operation; performance audits; and data retrieval activities. The contractor shall compile the resulting test data and perform numerical and statistical analysis, as needed. Data may also be obtained or supplemented from other existing sources such as the FEM program, other monitoring programs and studies and scientific publications and reports. The WA COR will issue technical directive identifying the locations and durations of the laboratory and/or ambient/field studies, technical problem or methodology to be researched or investigated and the scope of the research. It is anticipated that the ambient based studies will be performed at the AIRS sampling site in RTP and at the CAPABLE sampling site at NASA LaRC. In addition, field campaigns will be performed as part of the NASA led KORUS-AQ study during this performance period. The field campaign will be conducted in Seoul, South Korea with timing TBD and issued through technical directive. It is anticipated that up to three weeks of contractor support will be needed on-site in Seoul.

Task 4. Provide on-site technical support for identification and evaluation of next generation air monitoring methods for the gas phase criteria pollutants including NO2 and O3. Based upon technical direction from the WACOR, the contractor shall conduct laboratory and ambient based research activities, as appropriate or necessary, related to the evaluation of next generation air monitoring methods for O3, NO2, and other gas phase criteria pollutants. The research may include investigation of sensor measurement technologies associated with the individual NAAQS criteria pollutants and the applicability of these methods to the routine ambient monitoring. This work will be performed primarily in an ambient setting but may also involve controlled laboratory evaluations. The contractor support shall include, but is not limited to deployment of methods to ambient and laboratory sites; set-up, calibration and maintenance (through the electronics shop) of O3, NO2, and other reference instrumentation; daily site/laboratory operation; and data retrieval activities. The contractor shall compile the resulting test data and perform numerical and statistical analysis, as needed. The WA COR will issue technical directive identifying the locations and durations of the laboratory and/or

ambient/field studies, technical problem or methodology to be researched or investigated and the scope of the research. It is anticipated that the ambient based studies will be performed at the AIRS sampling site in RTP and at the CAPABLE sampling site at NASA LaRC. In addition, a field campaigns will be performed as part of the NASA led KORUS-AQ study during this performance period. The field campaign will be conducted in Seoul, South Korea with timing TBD and issued through technical directive. It is anticipated that up to three weeks of contractor support will be needed on-site in Seoul.

WA SPECIFIC EQUIPMENT

Work assignment specific equipment for use by the contractor on this work assignment includes but is not limited to:

- Analyzers for NO2, NOy, O3 and other criteria pollutant methods for use as primary and secondary NAAQS FRMs/FEMs.
- Next generation air monitoring methods including remote sensing and small sensor technologies for the gas phase criteria pollutants and meteorological parameters.
- Calibration and data acquisition equipment.
- Mobile monitoring shelters for use during field studies.

The WACOR will issue technical directive identifying the work assignment specific equipment to be used under each task.

QUALITY ASSURANCE

The contractor shall follow the detailed quality assurance project plan (QAPPs) "Methods Development, Evaluation, and Applications for Ambient Air Criteria Pollutants, Key Precursor Species, and Meteorological Variables" (QAPP in preparation, number TBD) for the tasks mentioned in the above section. This QAPPs covers laboratory and ambient methods and procedures relevant to this Work Assignment.

DELIVERABLES

A work plan containing a cost estimate shall be provided to the Contracting Officer (CO), PO and WA COR within 20 days of receipt of the Work Assignment or as specified in the contract.

The contractor shall provide deliverable(s) as indicated in each technical directive.

Progress on ancillary support shall be documented in the monthly reports, and shall be provided on an as-needed basis.

SCHEDULE of DELIVERABLES

The schedule for deliverable(s) will be provided in each technical directive.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-115

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Ronald Williams
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-2957
FAX Number:

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Next Generation Air Monitoring Technical Support

WA #:1-115 WACOR: Ron Williams

Contract #: EP-C-15-008 Alternate WACOR: Teri Conner

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from April 1, 2016 through March 31, 2017.

SUMMARY OF OBJECTIVES

This work assignment shall provide field and/or laboratory technical support involving the evaluation of Next Generation Air Monitor (NGAM) technologies. Such evaluations shall be associated with operation of the devices under conditions defined by the WA COR to provide for their comparison with reference monitors (e.g. FRMs, FEMS, or as designated by the WA COR). To assist the Contractor in understanding the full measure of this WA and development of their cost estimate, a kick off meeting will be held upon award at a time/date of the WA COR selection. It is anticipated this meeting shall occur within one week of the WA initiation date to facilitate spring deployment of low cost sensors and their evaluation. This kick off meeting shall involve key Contractor personnel associated with those anticipated to be involved in field-based evaluation/deployment of low cost sensor technologies and those involved in laboratory evaluation of said technologies. The Contractor is encouraged to review materials on the US EPA's Citizen Science Air Toolbox website (www.epa.gov/heasd/airsensortoolbox) as additional background information as to the previous work conducted in support of this research area.

The Contractor shall conduct efforts related to evaluation of low cost sensors in the Research Triangle Park, NC area as instructed through technical direction. Existing platforms like the AIRS and Triple Oak sites represent the dominant locations for such work although secondary locations in the local area might be required in some instances to establish sufficient variability in pollutant concentrations for evaluation purposes.

While the primary objective of this work assignment shall be operation of said NGAM devices under field and/or laboratory conditions, secondary objectives as per technical direction shall involve Contractor evaluation/summarization of NGAM produced test data.

BACKGROUND

ORD has been conducting a variety of both laboratory and field based evaluation of Next Generation Air Monitors (NGAM). This work assignment will provide for carry-on activities from the original effort (WA 0-115) in support of previously defined research plans. These previous efforts have included laboratory and/or field evaluations of numerous criteria and other air pollutant NGAM devices (e.g., nitrogen dioxide, ozone, particulate matter, volatile organic compounds, sulfur dioxide). ORD has published findings from some of these efforts through its Citizen Science Air Toolbox website.

During recent years, there have been significant advances in air pollution sensor technology. Specifically, sensors are now being developed that are much smaller and lower cost than traditional ambient air monitoring systems, with promising data. These types of sensors present an opportunity to advance EPA's strategic goals including community monitoring and environmental justice. One of the potential benefits of these sensors is the ability to deploy a larger number of sensors across a small geographic area (e.g. a neighborhood) and collect data with a level of geographic and temporal resolution that would be cost-prohibitive using traditional monitoring methods.

SCOPE

The Contractor shall conduct laboratory activities as designated by the WA COR onsite at the EPA-RTP campus as needed in support of sensor performance evaluations. This shall include developing calibration regressions for select pollutants (e.g., nitrogen dioxide, ozone) as defined by technical direction. Such laboratory activities shall involve potential refurbishment of NGAM devices if needed to accommodate satisfactory response prior to collocation at local test platforms. The WA COR shall provide technical direction on the NGAM devices to be recovered/refurbished/evaluated under laboratory conditions. No more than three (3) of any one brand/model of sensor package (replicate) will be evaluated and the Contractor shall estimate that a maximum of 10 such sensor types might be deployed during the period of performance. Field evaluation periods shall be conducted for a maximum of 160 days for any sensor type. For estimation purposes, the nominal length of deployment for any sensor shall be 90 days. To accommodate that total test period, the WA COR shall provide technical direction as to deployment of any sensor during any given season (spring 2016; summer 2016; fall 2016; winter 2016) to best accommodate the sensor type and research objective. Such technical direction might result in a sensor being deployed for short time periods (e.g., 1-2 weeks) in a given season followed by redeployment in another season. Technical direction will again be used to define deployment strategies. Field efforts shall involve local EPA RTP air monitoring platforms (AIRS-EPA RTP campus and/or EPA Triple Oaks Near Road trailer).

The WA COR shall provide full technical direction on the types, number, and length of deployment involving all NGAM devices. Contractor acquisition of some low cost NGAMs shall be performed under this work assignment with property accounting performed by the

Contractor in support of ORD property maintenance requirements. For work plan cost estimation purposes, the Contractor shall base the cost of all NGAMs purchased for evaluation at $10,000. Examples of the types of NGAM the Contractor shall evaluate for performance characteristics include but are not limited to (Array of Things; Aeroqual Series 500; Air Quality Egg; CSAM model #2; TZOA; UN sensor pod). The WA COR will identify to the Contractor sensors already available for testing at the initiation of the work assignment as compared to ones which shall need to be acquired.

TECHNICAL APROACH/OBJECTIVES

Task #1. EPA-RTP Laboratory/Field site NGAM Evaluation of Select Sensors

The Contractor shall conduct laboratory audits (calibration/zero) of select NGAM as per technical direction of the WA COR. Many NGAMs lack the immediate ability to conduct calibration via manifold or line transfer. Therefore, field evaluations shall be the dominant means of establishing basic performance features of most of the sensors evaluated in this work assignment.

The Contractor shall make ready local deployment site(s) and any needed equipment in advance of field deployment. The chicken coop structure used in the CAIRSENSE project shall be operated at the AIRS to support field testing of sensors. In the event sensors are deployed at the Triple Oaks platform, the WA COR will make available metal rain shelters previously used at that location and familiar to the Contractor. Space, power, and access to both test sites shall be made available by the WA COR. The WA COR is conducting a current market survey on late breaking sensors being developed. An initial work assignment meeting will establish an initial list of sensors discovered for evaluation and the Contractor shall not be responsible for discovery of NGAM. New sensors shall be identified to the Contractor as the performance period advances as they become discovered. The WA COR will not introduce any new sensor into the test regimen after December 1, 2016 to ensure the Contractor shall be able to acquire and deploy the sensors for a reasonable period of time (e.g., minimum of 30 days) during the performance period. The contractor shall acquire all discovered low cost sensors of interest for testing, with a total expenditure estimated at $10,000 used for cost estimation. No capital equipment (devices > $2500 each) shall be acquired. The WA COR shall approve the selection of all sensors associated with this task. All Contractor sensor test shall be performed in full agreement with the existing Quality Assurance Project Plans (QAPPs) that have been developed and currently in operation by the WACOR. The WA COR shall be responsible for amending existing QAPPs to cover this new work. The Contractor shall be responsible for developing all research operating procedures (ROPs) that the WA COR will use in developing said QAPP amendments. In situations where existing ROPs already exist, said ROPs will be provided to the Contractor for immediate use or amendment.

The Contractor shall install sensors at the designated test location on dates (seasons) approved by the WA COR. Only local travel shall be required. Material recovered from the Denver and/or Atlanta CAIRSENSE project and the original WA 0-115 (e.g., data loggers, power supplies, etc) already familiar to the Contractor shall be made available. The Contractor shall travel to the test location in accordance with the QAPP on a regular basis (at least weekly) and ensure all sensors are working and that data storage/transmission systems are functioning. The Contractor shall review the recovered data to inspect them for potential sensor or other failures on a weekly basis. The Contractor shall estimate that the full recovery (download and transfer) of data as well as a review of initial data quality shall not exceed a maximum of 4 hours per week in labor hours. Data format for these recovered data sets provided to the WA COR shall meet WA COR approved formats in these previously defined QAPPs.

The WA COR shall make available all needed reference monitoring data needed in support of the Contractor's requirement to establish performance characteristics of any device at a given test location (AIRS/Triple Oaks).

Task #2 Data summarization

The Contractor shall maintain electronic records of raw, validated, and processed sensor data associated with laboratory and field episodes. An example of the database format (e.g., Excel) to be used by the Contractor with clearly defined column headers shall be provided to the WA COR within 30 days of the first data download from field-based measurements. The WA COR shall review, provide commentary and ultimately approve the final required format to be used by the Contractor. The Contractor shall maintain all raw data and develop electronic documentation that clearly identifies each record (data download) associated with the evaluation. The WA COR will use technical direction to define for the Contractor the ultimate summary of all performance characterization so the Contractor may develop technical report(s) summarizing the findings. As a guideline, the Contractor shall use EPA peer review report formats such as those depicted on the EPA's Air Sensor Toolbox as estimates of the expected labor effort to complete data summarization. The Contractor shall make provision for more advanced statistical examination of data such as development of multi-linear regressions (sensor versus collocated reference monitors). A maximum of five such examinations shall be required by the WA COR. The WA COR will finalize all report(s) provided by the Contractor to meet EPA peer review standards. There is the potential for the Contractor to return a data summary (draft report) within 30 days of the end of data collections for a single WA COR identified sensor due to its high degree of importance to the overall research agenda. The identified sensor shall be identified at the planned kick off meeting of the work assignment if such an expedited summarization shall be required.

QUALITY ASSURANCE (QA)

Quality Assurance Project Plans (QAPPs) and their associated Research/Standard Operating Procedures (ROPs/SOPs) that define a majority of the expected work are already in existence

(NERL QAPPS QAPP-RM-13-01 (1) "Quality Assurance Project Plan – PM and VOC Sensor Evaluation" and QAPP-AB-12-03 "Quality Assurance Project Plan - ORD Sensor/Application Test Bed Challenge: Investigation of App/Sensor Response under Controlled Laboratory Conditions"). In addition, the existing NRMRL/NERL CAIRSENSE Regional Monitoring QAPP (QTRAK No. 14012) is in effect. QA guidelines associated with these three previously approved documents will be maintained and their quality assurance structure has been fully identified. One or more QAPP amendments defining new ROPs to be associated with this research will be developed by the WA COR and to which the Contractor shall use to cover the tasks associated with this SOW.

DELIVERABLES and their Schedule

Task 1 Field/Laboratory Sensor Evaluations

Deliverable 1.1. The contractor shall acquire all needed sensors needed in support of this work no later than December 1, 2016. Devices shall be obtained per technical direction of the WA COR.

Deliverable 1.2. The Contractor shall provide a WA COR approved research operating procedure for any NGAM device a minimum of 30 days prior to field deployment or initiation of any laboratory-based effort.

Deliverable 1.3. The Contractor shall deploy all NGAMs associated with field site evaluations by December 1, 2016 to ensure a minimum of 30 day collocation versus reference monitors.

Task #2 EPA- Data Summarization

Deliverable 2.1. Data shall be recovered from all NGAM devices deployed on a weekly basis as needed and inspected for operational status of all devices and/or evidence of instrument malfunction. The Contractor shall provide electronic copies of raw and validated field data once per month in a WA COR approved manner defined by the appropriate QAPP and associated SOP. The Contractor shall update each preceding database to include all new data collected during the project so that ultimately a single database containing all raw and validated data is delivered. A WA COR-approved version of an Excel workbook is an acceptable means of Contractor submission of both raw and processed data.

Deliverable 2.2. The contractor shall provide a two-page summary per sensor of the sensor field set-up, data logging process, and observations of utility for routine data collection, within 30 days of sampling completion for any sensor.

Deliverable 2.3. The Contractor shall provide full release of all data collected from laboratory and field evaluations by March 31, 2017. An Excel data format is required unless specific technical direction by the WA COR is provided in advance.

Deliverable 2.4. The Contractor shall provide a report summarizing test conditions and findings of all evaluations by March 31, 2017. To meet this delivery and the expectation that different sensors will be deployed throughout the performance feature, the Contractor shall provide installments to the ultimate final report on a quarterly basis (May 30th 2016, August 30th 2016, and November 30th 2016). A WA COR approved final report shall be provided by March 31, 2017.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-115

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2016

Base X Option Period Number

Title of Work Assignment/SF Site Name: 1-115 Citizen science/NexGen..

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:
Adding task 3.

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Ronald Williams
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-2957
FAX Number:

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Statement of Work (Amendment of WA 1-115)

WA Title: Next Generation Air Monitoring Technical Support

WA #:1-115 WACOR: Ron Williams

Contract #: EP-C-15-008 Alternate WACOR: Teri Conner

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from April 1, 2016 through March 31, 2017.

BACKGROUND

ORD has been conducting a variety of both laboratory and field based evaluation of Next Generation Air Monitors (NGAM). Expansion of the work currently being performed under WA 1-115 is needed to meet additional activities in the citizen science research area.

SCOPE

The Contractor shall conduct laboratory and field activities as designated by the WA COR as needed in support of a new task involving citizen science research.

TECHNICAL APROACH/OBJECTIVES

Task #3 Support of citizen group sensor evaluations

1. **The Contractor shall design and fabricate a small chicken coop-like shelter to provide for weather-protected collocation of a total of 6 low-cost citizen science monitors. Technical direction shall be provided as to the overall dimension of the shelter which would be expected to be approximately 1/6th the size of the shelter currently deployed at the AIRS. Up to two such shelters may be required, to be specified by the WA COR. The Contractor shall incur shipping charges to transport the shelters to WA COR-designated locations via commercial carriers (e.g., Fed Ex) using an estimate not to exceed a total of $500. The shelters should provide the means to provide AC power plug in for a maximum of six devices.**

2. **The contractor shall purchase a maximum of 12 (twelve) low cost sensors (e.g, individual units having an average cost of < $1000), to be specified by the WA COR in technical direction. The most likely monitors to be purchased are the Dylos DC1100 Pro, the Speck, or the Aeroqual S-500 ozone monitor). The Contractor shall be**

responsible for traveling to a maximum of two locations within the continental U.S. and providing citizen science groups hands-on training on the use of the sensors and the data regression tool (Excel macro) defined below. The Contractor shall estimate a total maximum travel budget of $3000 for these activities).

3. **The contractor shall develop or update, as needed, citizen science operating procedures to be provided to citizens as defined by technical direction. A maximum of four procedures is required to be developed. These shall be in the format and level of detail similar to those produced previously, such as the DYLOS DC1100 Citizen Science Operating Procedure (EPA/600/R-15/116). One such operating procedure shall be a portable weather station provided by EPA and to be used by citizen scientists in Puerto Rico.**

4. **The Contractor shall develop an easy-to-use Excel macro tools to perform the following functions: 1) enable citizen scientists to download sensor and reference monitor data, and 2) produce regression plots and statistics that report on the performance of the low-cost sensor compared with the reference monitor. The WA COR will use technical direction to define for the Contractor any specific performance of these tools. The tool shall be highly interactive so that it guides the user in a step by step process and informs them of either a successful or unsuccessful step. The Tool must be developed so that it is stand alone and can be made available (downloadable and then executable) to others via a web link (Air Sensors Toolbox). The Contractor is not responsible for any of the web-based use of the tool.**

5. **The Contractor shall develop a Powerpoint Presentation that explains in a step by step fashion the technical considerations of how one establishes a low cost sensor versus reference monitor performance evaluation. The presentation shall be interactive in that use of photos, hot links, or other visual aids shall be embedded in the document. The document shall work viewers at the citizen scientist comprehension level through key points described in the EPA's Sensor User Guidebook Appendix C (EPA 600/R-14/159 June 2014) concerning developing field-based collocation reference evaluations. The Contractor shall first develop simple bullet point (text) outline of the intended slide set and content to be reviewed by the WA COR. Technical direction will then be used to refine the design of the interactive slide deck through to its delivery. The data regression tool previously described shall be introduced as part of the slide set.**

QUALITY ASSURANCE (QA)

Quality Assurance Project Plans (QAPPs) and their associated Research/Standard Operating Procedures (ROPs/SOPs) that define a majority of the expected work are already in existence (NERL QAPPS QAPP-RM-13-01 (1) "Quality Assurance Project Plan – PM and VOC Sensor Evaluation" and QAPP-AB-12-03 "Quality Assurance Project Plan - ORD Sensor/Application Test

Bed Challenge: Investigation of App/Sensor Response under Controlled Laboratory Conditions"). In addition, the existing NRMRL/NERL CAIRSENSE Regional Monitoring QAPP (QTRAK No. 14012) is in effect. QA guidelines associated with these three previously approved documents will be maintained and their quality assurance structure has been fully identified. One or more QAPP amendments defining new ROPs to be associated with this research will be developed by the WA COR and to which the Contractor shall use to cover the tasks associated with this SOW.

DELIVERABLES and their Schedule

Task #3 EPA- Support of citizen group sensor evaluations

The Contractor shall build and then deliver to a maximum of two locations sensor evaluation shelters under the technical direction of the WA COR. Both shelters are to be built by September 30, 2016 with delivery occurring by December 1, 2016. Final delivery dates shall be provided to the Contractor by the WA COR following consultation with the citizen science group receiving the shelters. Shelters should be developed that are easy to assemble/ship to reduce shipping charges.

The Contractor shall travel to a maximum of two locations to deliver a half day (4 hours) of onsite training to citizen science groups on operating procedures for low cost sensors. The materials to be used shall be the citizen science operating procedures either already available from EPA or those to be produced by the Contractor if they currently do not exist or need to be updated. All training shall be completed by December 1, 2016 with dates defined by technical direction following consultation with the two citizen science groups. In like manner, the provision of the low cost sensors to be used in support of this task shall be obtained by December 1, 2016.

The Contractor shall update/develop all needed citizen science operating procedures to the satisfaction of the WA COR in support of this task by November 1, 2016.

The Contractor shall develop the macro regression tool to the satisfaction of the WA COR by October 1, 2016.

The Contractor shall provide the interactive PowerPoint presentation on technical considerations of sensor and reference monitor collocation procedures to the satisfaction of the WA COR by March 30, 2017.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-115

☐ Other ☒ Amendment Number: 000002

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017
Base Option Period Number 1

Title of Work Assignment/SF Site Name:

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:
The purpose of this amendment is to revise the PWS (revisions are in track changes).

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee — LOE:

Cumulative Approved: — Cost/Fee — LOE:

Work Assignment Manager Name: Ronald Williams
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-2957
FAX Number:

Project Officer Name: Robin S. Harris
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0955
FAX Number:

Other Agency Official Name:
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Candice Charlton
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2007
FAX Number:

Performance Statement of Work (Amendment of WA 1-115)

WA Title: Next Generation Air Monitoring Technical Support

WA #:1-115 WACOR: Ron Williams

Contract #: EP-C-15-008 Alternate WACOR: Teri Conner

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from April 1, 2016 through March 31, 2017.

BACKGROUND

ORD has been conducting a variety of both laboratory and field based evaluation of Next Generation Air Monitors (NGAM). Expansion of the work currently being performed under WA 1-115 is needed to meet additional acitivities in the citizen science research area.

SCOPE

The Contractor shall conduct laboratory and field activities as designated by the WA COR as needed in support of a new task involving citizen science research.

TECHNICAL APROACH/OBJECTIVES

Task #3 Support of citizen group sensor evaluations

1. **The Contractor shall design and fabricate a small chicken coop-like shelter to provide for weather-protected collocation of a total of 6 low-cost citizen science monitors. Technical direction shall be provided as to the overall dimension of the shelter which would be expected to be approximately 1/6th the size of the shelter currently deployed at the AIRS. Up to two such shelters may be required, to be specified by the WA COR. The Contractor shall incur shipping charges to transport the shelters to WA COR-designated locations via commercial carriers (e.g., Fed Ex) using an estimate not to exceed a total of $500. The shelters should provide the means to provide AC power plug in for a maximum of six devices.**

2. **The contractor shall purchase a maximum of 12 (twelve) low cost sensors (e.g, individual units having an average cost of < $1000), to be specified by the WA COR in technical direction. The most likely monitors to be purchased are the Dylos DC1100 Pro, the Speck, or the Aeroqual S-500 ozone monitor). The Contractor shall be**

responsible for traveling to a maximum of two locations within the continental U.S. and providing citizen science groups hands-on training on the use of the sensors and the data regression tool (Excel macro) defined below. The Contractor shall estimate a total maximum travel budget of $3000 for these activities).

3. **The contractor shall develop or update, as needed, citizen science operating procedures to be provided to citizens as defined by technical direction. A maximum of four procedures is required to be developed. These shall be in the format and level of detail similar to those produced previously, such as the DYLOS DC1100 Citizen Science Operating Procedure (EPA/600/R-15/116). One such operating procedure shall be a portable weather station provided by EPA and to be used by citizen scientists in Puerto Rico.**

4. **The Contractor shall develop an easy-to-use Excel macro tools to perform the following functions: 1) enable citizen scientists to download sensor and reference monitor data, and 2) produce regression plots and statistics that report on the performance of the low-cost sensor compared with the reference monitor. The WA COR will use technical direction to define for the Contractor any specific performance of these tools. The tool shall be highly interactive so that it guides the user in a step by step process and informs them of either a successful or unsuccessful step. The Tool must be developed so that it is stand alone and can be made available (downloadable and then executable) to others via a web link (Air Sensors Toolbox). The Contractor is not responsible for any of the web-based use of the tool.**

5. ~~**The Contractor shall develop a Powerpoint Presentation that explains in a step-by-step fashion the technical considerations of how one establishes a low-cost sensor versus reference monitor performance evaluation. The presentation shall be interactive in that use of photos, hot links, or other visual aids shall be embedded in the document. The document shall work viewers at the citizen scientist comprehension level through key points described in the EPA's Sensor User Guidebook Appendix C (EPA 600/R-14/159 June 2014) concerning developing field-based collocation reference evaluations. The Contractor shall first develop simple bullet point (text) outline of the intended slide set and content to be reviewed by the WA COR. Technical direction will then be used to refine the design of the interactive slide deck through to its delivery. The data regression tool previously described shall be introduced as part of the slide set.**~~

QUALITY ASSURANCE (QA)

Quality Assurance Project Plans (QAPPs) and their associated Research/Standard Operating Procedures (ROPs/SOPs) that define a majority of the expected work are already in existence (NERL QAPPS QAPP-RM-13-01 (1) "Quality Assurance Project Plan – PM and VOC Sensor Evaluation" and QAPP-AB-12-03 "Quality Assurance Project Plan - ORD Sensor/Application Test

Bed Challenge: Investigation of App/Sensor Response under Controlled Laboratory Conditions"). In addition, the existing NRMRL/NERL CAIRSENSE Regional Monitoring QAPP (QTRAK No. 14012) is in effect. QA guidelines associated with these three previously approved documents will be maintained and their quality assurance structure has been fully identified. One or more QAPP amendments defining new ROPs to be associated with this research will be developed by the WA COR and to which the Contractor shall use to cover the tasks associated with this SOW.

DELIVERABLES and their Schedule

Task #3 EPA- Support of citizen group sensor evaluations

The Contractor shall build and then deliver to a maximum of two locations sensor evaluation shelters under the technical direction of the WA COR. Both shelters are to be built by January 31, 2017 ~~September 30, 2016~~ with delivery (shipment to specified U.S. locations) occurring by march 1, 2017~~December 1, 2016~~. Final delivery dates shall be provided to the Contractor by the WA COR following consultation with the citizen science group receiving the shelters. Shelters should be developed that are easy to assemble/ship to reduce shipping charges.

The Contractor shall travel to a maximum of two locations to deliver a half day (4 hours) of onsite training to citizen science groups on operating procedures for low cost sensors. The materials to be used shall be the citizen science operating procedures either already available from EPA -or those to be produced by the Contractor if they currently do not exist or need to be updated. All training shall be completed by March 31~~December 1~~, 2017~~6~~ with dates defined by technical direction following consultation with the two citizen science groups. In like manner, the provision of the low cost sensors to be used in support of this task shall be obtained by February~~December~~ 1, 2017~~6~~.

The Contractor shall update/develop all needed citizen science operating procedures to the satisfaction of the WA COR in support of this task by March~~November~~ 1, 2017~~6~~.

The Contractor shall develop the macro regression tool to the satisfaction of the WA COR by February~~October~~ 1, 2017~~6~~.

~~**The Contractor shall provide the interactive PowerPoint presentation on technical considerations of sensor and reference monitor collocation procedures to the satisfaction of the WA COR by March 30, 2017.**~~

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-116

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base Option Period Number 1	1-116 MSSB

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 1, 6

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Eric S. Hall	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-3147 FAX Number: 919-541-1551
Project Officer Name Robin Baily	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Mark Cranley	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Completion of the Multi-Sector Sustainability Browser (**MSSB**)

WA #:1-116 **WACOR:** Eric S. Hall

Contract #: EP-C-15-008 **Alternate WACOR:** N/A

PERIOD OF PERFORMANCE:
The period of performance detailed in the Performance Statement of Work (**SOW**) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES:
This Work Assignment (**WA#1-116**) is being generated for Jacobs Technology Incorporated to complete the Multi-Sector Sustainability Browser (**MSSB**). The **MSSB** synthesizes the sustainability research in four decision sectors, Land Use, Buildings and Infrastructure, Transportation, and Materials Management (i.e., Municipal Solid Waste [**MSW**] Disposal/Processing).

BACKGROUND:
The **MSSB** was developed under Work Assignment #34 of Contract EP-D-11-060 with Oneida Total Integrated Enterprises (**OTIE**) as the contractor. The period of performance under which WA#34 was implemented was 01 April 2015 through 31 March 2016. The contractor workplan/**QAPP** was approved on 25 June 2015 (finalized 24 Sept 2015), and WA#34 was signed and approved by the EPA Contracting Officer on 04 August 2015. Eric S. Hall was the Work Assignment Contract Officer Representative (**WACOR**) for Contract EP-D-11-060 (Work Assignment #34, Michael George was the Contract-Level COR (**CLCOR**), Heather Pinney was the Contract Specialist (**CS**), and Kevin Logan was the Contracting Officer (**CO**). This work was performed under NERL **SHC** Task # **4.61.2**, (Project **4.61**, Integrated Solutions for Sustainable Communities).

EPA's Sustainable and Healthy Communities (**SHC**) Research Program is developing methodologies, resources, and tools to assist community members and local decision makers in implementing policy choices that facilitate sustainable approaches to managing their resources, which affect the built environment, natural environment, and human health. In order to assist communities and decision makers in implementing sustainable practices, EPA is developing computer-based systems including models, databases, web tools, and web browsers to help communities decide upon approaches which will support their desired outcomes. Communities need access to resources that will allow them to make decisions, which could reduce negative impacts on human health, the

economy, and the environment through intelligent decisions in four key decision sectors: Land Use, Buildings and Infrastructure, Transportation, and Materials Management.

The **MSSB** was built to provide a decision support tool (**DST**) containing information from the scientific literature and technical reports that must be considered when making decisions supporting sustainability in Land Use, Buildings and Infrastructure, Transportation, and Materials Management. The **MSSB** is capable of supporting communities and decision makers in choosing amongst alternative sustainability goals and assisting them in understanding the impacts that decisions made in Land Use, Buildings and Infrastructure, Transportation, and Materials Management can have on human health, the economy and the environment (ecosystem services). The **MSSB** has the following capabilities:

a. Generates and displays appropriate linkages/relationships between the major concepts of the four (4) decision sectors (Land Use, Buildings and Infrastructure, Transportation, and Materials Management) and the set of associated subordinate concepts related to each of those 4 decision sectors.

b. Displays/Lists literature sources/references providing information about each major concept and the associated subordinate concepts

c. Displays/Lists quantitative data and system parameters related to each major concept and the associated subordinate concepts.

The **MSSB** is relatively uncomplicated for users to operate, and behaves in a similar manner to the Eco-Health Relationship Browser (http://enviroatlas.epa.gov/enviroatlas/Tools/EcoHealth_RelationshipBrowser/index.html). The **Eco-Health Relationship Browser** is documented in the literature (Jackson, L. E., Daniel, J., McCorkle, B., Sears, A., Bush, K. F., "Linking ecosystem services and human health: the Eco-Health Relationship Browser", October 2013, International Journal of Public Health, Volume 58, Issue, 5, pp 747 – 755: DOI 10.1007/s00038-013-0482-1). The **Eco-Health Relationship Browser** is located on the EPA's ***EnviroAtlas*** website (https://www.epa.gov/enviroatlas).

SCOPE:

Scope of Work/Technical Direction. The EPA Work Assignment Contract Officer Representative (**WACOR**) will identify specific Work Assignment (**WA**) deliverables, their corresponding delivery dates, and will provide technical direction regarding the tasks/subtasks of the **WA** in the sections listed below. The **EPA WACOR** will supplement the technical direction provided in this scope of work with clarifying directives provided primarily through written technical direction. Any verbal technical direction provided by the **EPA WACOR** to the contractor will be followed by subsequent written (e.g., e-mail, facsimile, memo, letter, etc.) technical

direction from the **EPA WACOR**. The contractor shall maintain a file of all written and verbal technical direction received from the EPA **WACOR** under this **WA**. The technical direction provided by the **EPA WACOR** under this **WA** shall apply to each task and subtask element in this **WA**. The contractor shall not initiate action on any portion of this **WA** without prior written approval (e.g., e-mail, facsimile, memo, letter, etc., containing technical direction) from the EPA **WACOR**. The contractor shall utilize the Category III (3) Workplan-Quality Assurance Project Plan (**QAPP**) developed under EPA Contract EP-D-11-060, Work Assignment #34 (Effective Date: 25 June 2015; Final Approval: 24 September 2015) and the **SED** Software Development QA Guidance Document (**SED_Software_Development_QA_Guidance_2a.pdf**) as the basis of its Workplan/**QAPP**. The **EPA WACOR** will provide guidance and technical direction on the changes that need to be made to the Category III (3) Workplan-Quality Assurance Project Plan (**QAPP**) developed under EPA Contract EP-D-11-060, Work Assignment #34 (Effective Date: 25 June 2015; Final Approval: 24 September 2015) for this work assignment.

Resources Provided for/Utilized for Work Assignment. The contractor shall use the following resources provided by the **EPA WACOR** to complete the **MSSB**: **a)** the **MSSB** JavaScript source code; **b)** written technical direction (e.g., e-mails [primarily]); **c)** Microsoft Excel Spreadsheets; **d)** text for the **MSSB** displays; **e) Transportation Report** - Transportation Synthesis Paper - Final Submission 20130926.pdf; **f) Buildings and Infrastructure Report** - B&I Synthesis Report SHC 4 1 1_final.pdf; **g) Materials Management**/Municipal Solid Waste [**MSW**] **Report** - Materials_Management_White_Paper_Sept4_2012.pdf; **h) Land Use Report** - LU short and recommendations 011614.docx <u>and</u> FY13 Product NHEERL 4121 Land_Use_Synthesis.pdf [two separate documents]; **i)** the **SED** Software Development QA Guidance Document (**SED_Software_Development_QA_Guidance_2a.pdf**); **j)** the Category III (3) Workplan-Quality Assurance Project Plan (**QAPP**) developed under EPA Contract EP-D-11-060, Work Assignment #34 (Effective Date: 25 June 2015; Final Approval: 24 September 2015); **k)** the draft **MSSB** User Manual, and the draft **MSSB** journal article, and; **l)** other applicable Microsoft Word documents, and *.pdf documents [as required]) provided to complete the **MSSB**.

<u>TECHNICAL APROACH/OBJECTIVES</u>:

The following individual tasks and subtasks shown below are required to complete the **MSSB**, using the current version of the **MSSB** JavaScript source code, associated code, and related resources as the basis for continued **MSSB** development. The contractor shall complete each task and subtask activity listed below, and shall consult the **EPA WACOR** for explicit technical direction in the accomplishment of each task. The contractor shall also complete the **MSSB** User Manual and the **MSSB** journal article manuscript, using the current versions of each document provided by the **EPA WACOR**. **<u>Note</u>:** The **EPA WACOR** strongly

recommends the use of Oneida Total Integrated Enterprises (**OTIE**) as the subcontractor for this work assignment, based on **OTIE's** development of the **MSSB** and its familiarity with the software development, the software testing, and the software quality assurance requirements of the **MSSB**.

Task 1 (**Visual**). **Modify Main Display - Sustainability (Text Box)**
The following **text must be included**, as shown below (including bold type, italicized type, underlines, etc.), **in the Sustainability Main Display text box:**
"Welcome to the Multi-Sector Sustainability Browser (**MSSB**) Tool

The Multi-Sector Sustainability Browser (**MSSB**) is a community sustainability Decision Support Tool (**DST**), developed through the United States Environmental Protection Agency's (**EPA**'s) Sustainable and Healthy Communities (**SHC**) Research Program. The **MSSB** is designed to assist communities and decision makers in understanding the impacts that decisions made to support sustainability efforts in four key decision sectors, **Land Use**, **Buildings and Infrastructure**, **Transportation**, and **Materials Management** (i.e., Municipal Solid Waste [**MSW**] processing and disposal), can have on human health, the built environment, the natural environment (ecosystem services), and the economy. The **MSSB** displays the linkages and relationships between sustainability concepts influencing **Land Use**, **Buildings and Infrastructure**, **Transportation**, and **Materials Management**. It also includes information from the applicable sustainability literature sources, research reports, and the quantitative data and system parameters that must be considered when attempting to make intelligent sustainability decisions affecting **Land Use**, **Buildings and Infrastructure**, **Transportation**, and **Materials Management** in a community decision making context."

Task 2 (**Visual**). **Removal** of "**,NULL**" – JavaScript **Keyword**
The "**NULL**" JavaScript Keyword and preceding comma combination, "**,NULL**" must be removed for all instances where displayed in **MSSB**: **1)** Drop-Down Menu text, and; **2)** Node Display text that is currently (incorrectly) displayed as:

a) "**Density, Agglomeration (Grouping,NULL) and Creativity**" - should be displayed as: "**Density, Agglomeration (Grouping) and Creativity**"

b) "**Agglomeration (Grouping,NULL)**" - should be displayed as: "**Agglomeration (Grouping)**"

c) "**Report on the Environment**" Display - http://cfpub.epa.gov/roe/**,NULL** - should be displayed as: "http://cfpub.epa.gov/roe/"

Task 3 (**Visual**). **Removal of HTML Tag**

The "**<.h3>**" HTML Tag shown in the text box of the "Catalog of Common Sustainability Metrics" display requires removal. The text that is currently (incorrectly) displayed as:

a) "**Catalog of Common Sustainability Metrics<.h3>**"- should be displayed as: "**Catalog of Common Sustainability Metrics**"

Task 4 (**Visual**). **Missing Text** in Displays
Text is missing in two **MSSB** Displays. The text that is currently (incorrectly) displayed as:

a) "**USDA/DOT/EPA Document on Rural Community Performance Measures (Rural Prosperity)**" - should be displayed as: "**HUD/USDA/DOT/EPA Document on Rural Community Performance Measures (Rural Prosperity)**"

b) "**of Ecosystem Goods and Services, Human Health Impacts, and Identification of Thresholds**" - should be displayed as: "**Quantification of Ecosystem Goods and Services, Human Health Impacts, and Identification of Thresholds and Tipping Points**"

Task 5 (**Visual**). **Text Extends Outside of Display Node** ('Text Bubble')
Text extends beyond the 'text bubble' in four **MSSB** Displays. The affected displays are as follows:

a) "HUD/USDA/DOT/EPA Document on Rural Community Performance Measures (Rural Prosperity)"

b) "Quantification of Ecosystem Goods and Services, Human Health Impacts, and Identification of Thresholds and Tipping Points"

c) "ORD Recent and Planned Products Relevant to Land Use Decisions and Sustainability"

d) "Correlations and Elasticities Regarding the Built Environment and Travel Behavior"

e) **Note:** Suggested resolutions include:

i. Increasing the size of the 'text bubble' for each instance of the displays
ii. Reducing the font size of the text in each instance for the affected displays

Task 6 (**Visual**). **Extend the length of the Drop-Down Menu** (Topic Bar) Area The length of the drop-down menu/topic bar must be increased to accommodate the length of the following two topic titles (**Note:** Ensure that there is enough 'buffer space' to prevent clashing/visual interference of title elements.):

a) "HUD/USDA/DOT/EPA Document on Rural Community Performance Measures (Rural Prosperity)"

b) "Quantification of Ecosystem Goods and Services, Human Health Impacts, and Identification of Thresholds and Tipping Points"

Task 7 (**Visual**). **Paragraphs** (explanatory text, excluding paragraph title) in the following display text boxes **are in bold (bold face) type** and **should be in normal** ('un-bold') **type:**

a) "Mixed Uses"

b) "Economic Advantages of Walkable Places"

c) "Decision Analysis for a Sustainable Environment, Economy, and Society (DASEES)"

d) "Catalog of Common Sustainability Metrics"

e) "Image Analysis Support for Green Infrastructure Projects"

Task 8 (**Visual**). **Paragraphs** (explanatory text, excluding paragraph title) in the following display text boxes **should be placed underneath (beneath) their respective paragraph titles:**

a) "Economic Advantages of Walkable Places"

b) "Catalog of Common Sustainability Metrics"

c) "Image Analysis Support for Green Infrastructure Projects"

d) "Density" – Note: The paragraph title for this display text box should be in bold (bold face) type.

Task 9 (**Operational**). **Drop-Down Menu Display**: The following **drop-down menu option/selection does not move (cycle to the selection) and is not selectable.** Also, this option/selection **is not displayed/displayable:**

a) "Neighborhood Vitality Index (NVI):" – **Note:** All drop-down menu selections before this particular menu selection and all drop-down menu selections that follow this particular menu selection are selectable, operate as designed, and are displayed/displayable as required.

Task 10 (**Visual**). **Drop-Down Menu Display**: The following **drop-down menu option/selection has an extraneous colon (":") that must be removed:**

a) **"Neighborhood Vitality Index (NVI):"** - should be displayed as: **"Neighborhood Vitality Index (NVI)"**

Task 11 (**Operational**). The displays listed below have the following three operational issues in common: **1)** the ***link "+" symbol is not displayed*** as required **on the 'arrows' illustrating the linkages** between 2 (or more) display nodes/node concepts; **2)** the ***link text boxes***, which should be displayed with the appropriate text when the link "+" symbol is selected ('clicked'), ***do not exist/are not displayed*** (see **1)**); **3)** the ***link text***, which should be displayed with the appropriate text when the link "+" symbol is selected ('clicked'), ***does not exist/is not displayed*** (see **1)** and **2)**):

a) ***All Links*** (**What Neighborhood Scale Land Use Qualities Are Most Important For Advancing Sustainability?**; **Retail Revenue**; **Transit-Oriented Development (TOD)**; **Lower Obesity/Body Mass Index (BMI)**; **Walkability**; **Adjacent Large Parks**; **Transit Stops**; **Trees**) and the associated Link Text paragraphs ***for "Property Values" display are missing/not displayed*** – must be completed

b) ***Six (6) Links*** (**Walking for Transportation**; **Fewer Extreme Heat Events**; **Lower Health Disparity**; **Mental Well-Being**; **Park Use**; **Active Transportation, Physical Activity, Health, and Social Well-Being**) and the associated Link Text paragraphs ***for "What Regional Land Use Qualities Are Most Important for Advancing Sustainability" display are missing/not displayed*** – must be completed

c) ***All Links*** (**Housing Age**; **Intersection Density**; **Mixed Use**; **What Regional Scale Land Use Qualities Are Most Important For Advancing Sustainability?**) and the associated Link Text paragraphs ***for "Walking For Transportation" display are missing/not displayed*** – must be completed

d) ***All Links*** (**Pleasant Aesthetics**; **Perception of Safety**; **Active Transportation, Physical Activity, Health, and Social Well-Being**) and the associated Link Text paragraphs ***for "Walking For Leisure" display are missing/not displayed*** – must be completed

e) ***Link*** (**What Regional Scale Land Use Qualities Are Most Important For Advancing Sustainability?**) and the associated Link Text paragraph ***for "Fewer Extreme Heat Events" display is missing/not displayed*** – must be completed

f) ***Link*** (**Lower Crime**) and the associated Link Text paragraph ***for "Greening/Infill Vacant (Land) Parcels" display is missing/not displayed*** – must be completed

g) ***Link*** (**Lower Health Disparity**) and the associated Link Text paragraph ***for "Green Neighborhoods" display is missing/not displayed*** – must be completed

h) ***All Links*** (**What Regional Scale Land Use Qualities Are Most Important For Advancing Sustainability?**; **Exposure to Greenspace**; **Shorter Commute Time**) and the associated Link Text paragraphs ***for "Mental Well-Being" display are missing/not displayed*** – must be completed

i) ***All Links*** (**Shorter Commute Time**; **Mixed-Use and Walkable**; **Housing Age Diversity**; **Density (40 Units Per Acre)**) and the associated Link Text paragraphs ***for "Social Capital" display are missing/not displayed*** – must be completed

j) ***All Links*** (**What Regional Scale Land Use Qualities Are Most Important For Advancing Sustainability?**; **Park Qualities**; **Park Amenities**) and the associated Link Text paragraphs ***for "Park Use" display are missing/not displayed*** – must be completed

k) ***All Links*** (**Productivity**; **Low Infrastructure or Service Cost**; **Efficient Transit**; **Property Values**; **Retail Revenue**; **Traffic Safety**; **Greenhouse Gas (GHG) Emissions per Person**; **Less Driving-Vehicle Miles Travelled**; **Social Capital**; **Traffic Congestion**; **Low Residential Energy Use**; **Personal Income**; **Productivity and Low Infrastructure Cost**) and the associated Link Text paragraphs ***for "Regional Coordination to Avoid Unintended Consequences" display are missing/not displayed*** – must be completed

l) ***Link*** (**Less Driving-Vehicle Miles Travelled**) and the associated Link Text paragraph ***for "Centralization" display is missing/not displayed*** – must be completed

m) ***All Links*** (**Less Driving-Vehicle Miles Travelled**; **Transit Use**) and the associated Link Text paragraphs ***for "Intersection Density" display are missing/not displayed*** – must be completed

n) ***All Links*** (**Intersection Density**; **Fewer Parking Spaces**; **Transit-Oriented Development**; **Distance to Transit Stop**) and the associated Link Text paragraphs ***for "Transit Use" display are missing/not displayed*** – must be completed

o) ***Link*** (**Less Driving-Vehicle Miles Travelled**) and the associated Link Text paragraph ***for "Job Accessibility By Auto" display is missing/not displayed*** – must be completed

p) ***All Links*** (**Low Residential Energy Use**; **Greening/Infill Vacant (Land) Parcels**) and the associated Link Text paragraphs ***for "Lower Crime" display are missing/not displayed*** – must be completed

q) ***Link*** (**Low Residential Energy Use**) and the associated Link Text paragraph ***for "Moderate Density (24-32 units per acre)" display is missing/not displayed*** – must be completed

r) ***Link*** (**Personal Income**) and the associated Link Text paragraph ***for "Growth Controls" display is missing/not displayed*** – must be completed

s) ***Link*** (**Productivity and Low Infrastructure Cost**) and the associated Link Text paragraph ***for "Density" display is missing/not displayed*** – must be completed; also, ***the text paragraph should be under the title***, and ***the title (Density) should be bold type***

t) ***Link*** (**Regional Coordination to Avoid Unintended Consequences**) and the associated Link Text paragraph ***for "Efficient Transit" display is missing/not displayed*** – must be completed

u) ***All Links*** (**Regional Coordination to Avoid Unintended Consequences**; **Prosperity**; **Low Density**) and the associated Link Text paragraphs ***for "Greenhouse Gas (GHG) Emissions Per Person" display are missing/not displayed*** – must be completed

v) ***All Links*** (**Intersection Density**; **Job Accessibility by Auto**; **Centralization**; **Regional Coordination to Avoid Unintended Consequences**) and the associated Link Text paragraphs ***for "Less Driving – Vehicle Miles Travelled (VMT)" display are missing/not displayed*** – must be completed

w) ***Link*** (**Regional Coordination to Avoid Unintended Consequences**) and the associated Link Text paragraph ***for "Low Infrastructure Or Service Cost" display is missing/not displayed*** – must be completed

x) ***All Links*** (**Regional Coordination to Avoid Unintended Consequences**; **Lower Crime**; **Moderate Density (24-32 units per acre)**) and the associated Link Text paragraphs ***for "Low Residential Energy Use" display are missing/not displayed*** – must be completed

y) ***All Links*** (**Regional Coordination to Avoid Unintended Consequences**; **Growth Controls**) and the associated Link Text paragraphs ***for "Personal Income" display are missing/not displayed*** – must be completed

z) ***Link*** (**Regional Coordination to Avoid Unintended Consequences**) and the associated Link Text paragraph ***for "Productivity" display is missing/not displayed*** – must be completed

aa) ***All Links*** (**Regional Coordination to Avoid Unintended Consequences**; **Density**) and the associated Link Text paragraphs ***for "Productivity and Low Infrastructure Cost" display are missing/not displayed*** – must be completed

bb) ***Link*** (**Regional Coordination to Avoid Unintended Consequences**) and the associated Link Text paragraph ***for "Property Values" display is missing/not displayed*** – must be completed

cc) ***Link*** (**Regional Coordination to Avoid Unintended Consequences**) and the associated Link Text paragraph ***for "Retail Revenue" display is missing/not displayed*** – must be completed

dd) ***Link*** (**Regional Coordination to Avoid Unintended Consequences**) and the associated Link Text paragraph ***for "Social Capital" display is missing/not displayed*** – must be completed

ee) ***Link*** (**Regional Coordination to Avoid Unintended Consequences**) and the associated Link Text paragraph ***for "Traffic Congestion" display is missing/not displayed*** – must be completed

ff) ***All Links*** (**Regional Coordination to Avoid Unintended Consequences**; **Low Sprawl Index**; **More Walkers and Bicyclists**; **Transit Use**) and the associated Link Text paragraphs ***for "Traffic Safety" display are missing/not displayed*** – must be completed

gg) ***All Links*** (**Air Pollution (Immediate Vicinity)**; **Accessibility by Auto**; **Parks and Tree Cover**; **Diversity**; **Mix of Housing Types**; **Urban Areas**; **Construction Jobs**; **Growth Management Policies**; **Cooler Air Temperatures**;

Extreme Heat Events; **Sprawl**; **Clean Air (In Region)**) and the associated Link Text paragraphs ***for "Synergies Between Land Use and Transportation" display are missing/not displayed*** – must be completed

hh) ***Link*** (**Compact Development Pattern**) and the associated Link Text paragraph ***for "Best Practices and Unintended Consequences" display is missing/not displayed*** – must be completed

ii) ***Link*** (**Compact Development Pattern**) and the associated Link Text paragraph ***for "Commute Times in Compact Development" display is missing/not displayed*** – must be completed

jj) ***Link*** (**Compact Development Pattern**) and the associated Link Text paragraph ***for "Compact Development and Walkability" display is missing/not displayed*** – must be completed

kk) ***All Links*** (**Impervious Surfaces and Compact Development**; **Energy Consumption and Compact Development**; **Best Practices and Unintended Consequences**; **Commute Times in Compact Development**; **Housing Affordability in Compact Cities**; **Smart Growth and Job Creation**; **Green Infrastructure/Low-Impact Development**; **Open Space**; **Fewer Extreme Heat Events**; **Traffic Congestion**; **Compact Development**, **Land Conservation, and Extreme Heat Events**; **Congestion and Compact Development**; **Compact Development and Walkability**; **Clean Air (In Region)**) and the associated Link Text paragraphs ***for "Compact Development Pattern" display are missing/not displayed*** – must be completed

ll) ***All Links*** (**Intersection Density**; **Mixed Use**; **What Regional Scale Land Use Qualities Are Most Important For Advancing Sustainability?**; **Housing Age**) and the associated Link Text paragraphs ***for "Walking For Transportation" display are missing/not displayed*** – must be completed

Task 12 (**Visual**). **Quantitative Relationships for applicable Land Use display nodes** must be incorporated into the **MSSB** display.

Task 13 (**Operational**). **Remaining citations for Land Use must be included in the Bibliography Section**/Component of **MSSB**.

Task 14 (**Visual**). **Images for Land Use (4 images), Buildings and Infrastructure (7 images), and Transportation (2 images) must be incorporated** into the applicable **MSSB** displays.

Task 15 (**Operational**). **Weblinks/links must be provided for the Land Use Report document** and the **MSSB User Manual**, and operate in the same manner as the weblinks/links for the *Buildings and Infrastructure Report*, *Transportation*

Report, and *Materials Management Report*, so that the **Land Use Report document** and the **MSSB User Manual** can be selected by the **MSSB** user when each document is finalized/completed.

Task 16 (**Technical Direction**)
The **EPA** Work Assignment Contract Officer Representative (**WACOR**) will identify specific Work Assignment (**WA**) deliverables, and their corresponding delivery dates, in the ***Deliverables*** and ***Schedule of Deliverables*** Sections of this document. The **EPA WACOR** will provide technical direction regarding the tasks/subtasks of this **WA**. The **EPA WACOR** will supplement the technical direction provided in this scope of work with clarifying directives (e.g., **i)** ensuring that an e-mail link to the **EPA WACOR** e-mail address is implemented in **MSSB** to provide answers to **MSSB** user questions; **ii)** implementing implied requirements which support/complete the explicitly stated requirements specified in this scope of work; **iii)** how to complete the **MSSB** User Manual and the **MSSB** journal article manuscript to properly document and describe **MSSB** design, behavior, and operational principles; **iv)** integration of the **MSSB** onto the EPA ***EnviroAtlas*** website [https://www.epa.gov/enviroatlas], etc.), provided primarily through written technical direction e-mails. Any verbal technical direction provided by the **EPA WACOR** to the contractor will be followed by subsequent written (e.g., e-mail, facsimile, memo, letter, etc.) technical direction. The contractor shall maintain a file of all written and verbal technical direction received from the **EPA WACOR** under this **WA**. The technical direction provided by the **EPA WACOR** under this **WA** shall apply to each task and subtask element in this **WA**. The contractor shall provide general support, to include maintaining the Amazon Web Service (**AWS**) website (http://54.161.236.169/), which hosts the version of the **MSSB**, used for peer-review analysis, operational testing, and integration testing, required to develop and deliver each **WA** deliverable to the **EPA WACOR**. The contractor shall not initiate action on any portion of this **WA** without prior written approval (e.g., e-mail, facsimile, memo, letter, etc., including technical direction) from the **EPA WACOR**. The contractor shall not be required to travel during the period of performance of this **WA**. Any non-local travel directly chargeable to this **WA** shall be submitted to and approved by the **EPA WACOR** prior to the travel. The contractor's Workplan-Design Document/Software Development **QAPP** must be approved by the **EPA WACOR** before any activity is initiated on this **WA**.

Task 17 (**Prepare monthly progress reports, task/subtask estimates, weekly status reports, and attend weekly teleconference meetings with the EPA WACOR**)

The contractor shall prepare and submit monthly progress reports, including monthly costs and manhour expenditures in electronic format, to the **EPA WACOR** for review and approval. The contractor shall prepare and submit task/subtask estimates in the Workplan-Design Document/Software Development **QAPP**, as indicated, in ***Task 19*** of this work assignment. The contractor shall prepare and

submit weekly written status reports in electronic format to the **EPA WACOR** before each weekly teleconference meeting. The contractor shall also prepare written summaries of conference calls/teleconference meetings with the **EPA WACOR** in electronic format. The weekly status report shall contain as a minimum: **(a)** the status of the Land Use, Buildings/Infrastructure, Transportation, Materials Management (**MSSB**) software code generation/modification/maintenance activities (e.g., analysis/code/test, etc.); **(b)** the status of the **MSSB** document development activities (i.e., **MSSB** User Manual and **MSSB** journal article manuscript, which document the **MSSB** design and operational behavior); **(c)** the number of man-hours expended on each task during the week [including **(a)** and **(b)** above]; **(d)** the status of work assignment deliverables (e.g., source code, documents [**MSSB** User Manual and **MSSB** journal article manuscript], etc.) for each work assignment task and/or work assignment subtask; **(e)** the current amount of funds expended based on **(a)**, **(b)**, **(c)**, and **(d)**.

The **EPA WACOR** will designate a consistent day and time for each weekly teleconference meeting and will notify the contractor of the scheduled day for each teleconference meeting upon award of the work assignment and approval of the contractor's Workplan-Design Document/Software Development **QAPP** by the **EPA WACOR**. The **EPA WACOR** reserves the right to change the day of the weekly teleconference meeting or cancel it when required. If the **EPA WACOR** travels to the contractor location during the period of this work assignment, the **EPA WACOR** visit(s) will substitute for the regularly scheduled weekly teleconference meeting. The **EPA WACOR** will provide technical direction during the weekly teleconference meetings. Technical direction will also be provided through e-mails, facsimiles, memos, letters, etc., and through periodic site visits to the contractor's location as applicable.

QUALITY ASSURANCE:

Task 18 (Include and Implement Work Assignment Quality Assurance Requirements in Workplan-Design Document/Software Development QAPP)

The contractor shall incorporate the entire **SED** Software Development QA Guidance Document (**SED_Software_Development_QA_Guidance_2a.pdf**) by reference into the Workplan-Design Document/Software Development **QAPP** it develops and submits to the **EPA WACOR** for this work assignment. The contractor shall implement the required software quality assurance and quality control (**QA/QC**) provisions in the **SED** Software Development QA Guidance Document (as incorporated into the Workplan-Design Document/Software Development **QAPP**) into the activities of this work assignment during the period of performance of this work assignment. The contractor shall use the Category III (3) Workplan-Quality Assurance Project Plan (**QAPP**) developed under EPA Contract EP-D-11-060, Work Assignment #34 (Effective Date: 25 June 2015; Final Approval: 24 September

2015) as the basis of the Workplan-Quality Assurance Project Plan (**QAPP**) submitted under this work assignment.

***Task 19* (*Deliver Workplan-Design Document/Software Development QAPP {Quality Assurance Project Plan} for Work Assignment to the EPA WACOR*)**

The contractor shall prepare and deliver a Workplan-Design Document/Software Development **QAPP** to address the completion of each task and subtask in this work assignment no later than **(NLT) 10 *calendar* days** after award of this work assignment. The Workplan-Design Document/Software Development **QAPP** shall include as a minimum a cost estimate (i.e., dollars and man-hours), and shall be structured by work assignment task and subtask (where applicable), along with a description of the required activities to complete each task and subtask (where applicable) of this work assignment. The contractor shall provide a list of all software used in the modification, testing, and integration of the **MSSB** code base (e.g., JavaScript, D3.js, JSON, HTML, XML, etc.), and shall describe and specify each type of software used in all work assignment tasks/subtasks/activities (e.g., build software, configuration management software, link/load software, compiler, interpreter, (e.g., **JVM** – Java Virtual Machine), module test/system test software, database software, etc.). The Workplan-Design Document/Software Development **QAPP** shall include information on the organization of the file and directory structure of the **MSSB** code, and information on how the **MSSB** code should be integrated into the EPA ***EnviroAtlas*** website. The contractor shall adhere to the software **QA/QC** requirements as delineated in this statement of work. Work shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff. The **MSSB** is an EPA Category III (3) scientific product, with corresponding **QA/QC** requirements.

DELIVERABLES:

***Task 20* (Deliver Completed MSSB Source Code, Executable/Operational Code, and Documentation to the EPA WACOR)**

The contractor shall complete the **MSSB** software source code, executable/operational code, and its associated documentation (e.g., **MSSB** User Manual, **MSSB** journal article manuscript, Workplan-Design Document/Software Development **QAPP** [including browser software test and quality assurance/**QAPP** provisions], source code listings (*including comments in the **MSSB** source code to support and enhance readability for current and future **MSSB** code maintenance*), progress/status reports, etc. [in electronic format]), as directed in the tasks and subtasks of this work assignment. The Workplan-Design Document/Software Development **QAPP** (including browser software test and quality assurance/**QAPP** provisions, and including provisions for *comments in the **MSSB** source code to support and enhance readability for current and future **MSSB** code maintenance*)

shall be delivered to the **EPA WACOR** no later than (**NLT**) ***10 calendar days after the formal award of this work assignment***, as shown in the delivery schedule provided below. During this contract work assignment, the contractor shall deliver interim versions of the **MSSB** software source code, and executable code to the **EPA WACOR** on a periodic (e.g., weekly, bi-weekly, or monthly) basis for the **EPA WACOR** to review and to provide technical direction on any further **MSSB** source code maintenance or **MSSB** source code modifications that may be required. Upon completion of **MSSB** software source code modifications and the **MSSB** document (**MSSB** User Manual and **MSSB** journal article) modifications/revisions, the contractor shall deliver the following to the **EPA WACOR** upon the conclusion of this work assignment: **(a)** final version of the complete (modified) **MSSB** software source code, compatible with the Windows 7 Operating System (loaded onto CD-ROM[s]/DVD[s]/memory stick(s)); **(b)** final version of the complete (modified) **MSSB** software executable code, compatible with the Windows 7 Operating System (loaded onto CD-ROM[s]/DVD[s]/memory stick(s)); **(c)** final version of the complete (modified) **MSSB** documentation (e.g., **MSSB** User Manual, **MSSB** journal article manuscript, Workplan-Design Document/Software Development **QAPP** [including browser software test and quality assurance/**QAPP** provisions and provisions for *comments in the **MSSB** source code to support and enhance readability for current and future **MSSB** code maintenance*]), (loaded onto CD-ROM[s]/DVD[s]/memory stick(s)). **Note:** Delivery of **(a)**, **(b)**, and **(c)** by File Transfer Protocol (**FTP**), and subsequent download by **EPA WACOR**, is acceptable.

The contractor shall deliver: **a)** the final **MSSB** software source code, compatible with Windows 7 32-bit and 64-bit Operating System versions; **b)** the final **MSSB** software executable code, compatible with Windows 7 32-bit and 64-bit Operating System versions, and; **c)** the **MSSB** documentation (i.e., **MSSB** User Manual and **MSSB** journal article manuscript) to the **EPA WACOR** no later than (**NLT**) ***10* business *days prior to the final delivery date*** as specified below for this work assignment. The **EPA WACOR** will review **a)**, **b)**, and **c)** and will provide technical direction to the contractor. The contractor shall incorporate the technical direction from the **EPA WACOR** into the final deliverable version of **a)**, **b)**, and **c)**. The contractor shall deliver the final versions of **a)**, **b)**, and **c)** to the **EPA WACOR** NLT **5 business days prior to the final delivery date** as specified below for this work assignment.

SCHEDULE of DELIVERABLES:

All work assignment deliverables shall be delivered in the format(s) as specified in ***Task 19*** and ***Task 20***. Acceptance criteria for all deliverables shall be consistent with the contract-level Statement of Work. **Note: DAC*** – Days Ater Contract/Work Assignment Award Date.

Activity/Deliverable/Milestone	Delivery Schedule

Task 16 – Implement General Technical Direction/Provide General Support	On-Going/Continuous
Task 17	
Monthly Progress Reports	Monthly
Weekly Status Reports	Weekly
Teleconference Meetings	Weekly
Task 18/Task 19 – Workplan-Design Document/Software Development **QAPP**	10 **DAC*** (Includes Task/Subtask Estimates)
Task 20 – MSSB Source Code [**Listings**] - Draft Final Version	**05 Aug 2016**: 10 Days before delivery date
Task 20 – MSSB Executable - Draft Final Version	**05 Aug 2016**: 10 Days before delivery date
Task 20 – MSSB User Manual - Draft Final Version	**05 Aug 2016**: 10 Days before delivery date
Task 20 – MSSB Journal Article - Draft Final Version	**05 Aug 2016**: 10 Days before delivery date
Task 20 – MSSB Source Code [**Listings**] - Final Version	**12 Aug 2016**: 5 Days before delivery date
Task 20 – MSSB Executable - Final Version	**12 Aug 2016:** 5 Days before delivery date
Task 20 – MSSB User Manual - Final Version	**12 Aug 2016:** 5 Days before delivery date
Task 20 – MSSB Journal Article - Final Version	**12 Aug 2016:** 5 Days before delivery date
Final Delivery Date	**19 Aug 2016**

WORK ASSIGNMENT PERIOD OF PERFORMANCE:

The period of performance of this work assignment shall begin on the date that this work assignment is formally awarded (i.e., the date of the Contracting Officer's signature) and shall be completed no later than March 31, 2017. **Note:** This work assignment shall be completed as indicated in the deliverable schedule above. This delivery schedule may be adjusted by the **EPA WACOR** as applicable.

EPA WACOR:

Eric S. Hall
U.S. Environmental Protection Agency (**EPA**)
Office of Research and Development (**ORD**)
National Exposure Research Laboratory (**NERL**)
Systems Exposure Division (**SED**)
109 TW Alexander Drive, MD E205-03
Research Triangle Park, NC 27711-0001
E-Mail: Hall.EricS@epa.gov
Phone: (919) 541-3147
FAX: (919) 541-1551

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-116

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base Option Period Number 1	Amendment 1

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Eric S. Hall (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3147 FAX Number: 919-541-1551
Project Officer Name Robin S. Harris (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-0955 FAX Number:
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Mark Cranley (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

Performance Statement of Work AMENDMENT

WA Title: Completion of the Multi-Sector Sustainability Browser (**MSSB**): **Amendment 1**

WA #:1-116 **WACOR:** Eric S. Hall

Contract #: EP-C-15-008 **Alternate WACOR:** N/A

PERIOD OF PERFORMANCE:
The period of performance detailed in the Performance Statement of Work (**SOW**) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES:
This Work Assignment (**WA#1-116**) is being generated for Jacobs Technology Incorporated to complete the Multi-Sector Sustainability Browser (**MSSB**). The **MSSB** synthesizes the sustainability research in four decision sectors, Land Use, Buildings and Infrastructure, Transportation, and Materials Management (i.e., Municipal Solid Waste [**MSW**] Disposal/Processing).

BACKGROUND:
The **MSSB** was originally developed under Work Assignment #34 of Contract EP-D-11-060 with Oneida Total Integrated Enterprises (**OTIE**) as the contractor. The period of performance under which WA#34 was implemented was 01 April 2015 through 31 March 2016. The contractor workplan/**QAPP** was approved on 25 June 2015 (finalized 24 Sept 2015), and WA#34 was signed and approved by the EPA Contracting Officer on 04 August 2015. Eric S. Hall was the Work Assignment Contract Officer Representative (**WACOR**) for Contract EP-D-11-060 (Work Assignment #34, Michael George was the Contract-Level COR (**CLCOR**), Heather Pinney was the Contract Specialist (**CS**), and Kevin Logan was the Contracting Officer (**CO**). This work was performed under NERL **SHC** Task # **4.61.2**, (Project **4.61**, Integrated Solutions for Sustainable Communities).

EPA's Sustainable and Healthy Communities (**SHC**) Research Program is developing methodologies, resources, and tools to assist community members and local decision makers in implementing policy choices that facilitate sustainable approaches to managing their resources, which affect the built environment, natural environment, and human health. In order to assist communities and decision makers in implementing sustainable practices, EPA is developing computer-based systems including models, databases, web tools, and web browsers to help communities decide upon approaches which will support their desired outcomes. Communities need access to resources that will allow them to

make decisions, which could reduce negative impacts on human health, the economy, and the environment through intelligent decisions in four key decision sectors: Land Use, Buildings and Infrastructure, Transportation, and Materials Management.

The **MSSB** was built to provide a decision support tool (**DST**) containing information from the scientific literature and technical reports that must be considered when making decisions supporting sustainability in Land Use, Buildings and Infrastructure, Transportation, and Materials Management. The **MSSB** is capable of supporting communities and decision makers in choosing amongst alternative sustainability goals and assisting them in understanding the impacts that decisions made in Land Use, Buildings and Infrastructure, Transportation, and Materials Management can have on human health, the economy and the environment (ecosystem services). The **MSSB** has the following capabilities:

a. Generates and displays appropriate linkages/relationships between the major concepts of the four (4) decision sectors (Land Use, Buildings and Infrastructure, Transportation, and Materials Management) and the set of associated subordinate concepts related to each of those 4 decision sectors.

b. Displays/Lists literature sources/references providing information about each major concept and the associated subordinate concepts

c. Displays/Lists quantitative data and system parameters related to each major concept and the associated subordinate concepts.

The **MSSB** is relatively uncomplicated for users to operate, and behaves in a similar manner to the Eco-Health Relationship Browser (http://enviroatlas.epa.gov/enviroatlas/Tools/EcoHealth_RelationshipBrowser/index.html). The **Eco-Health Relationship Browser** is documented in the literature (Jackson, L. E., Daniel, J., McCorkle, B., Sears, A., Bush, K. F., "Linking ecosystem services and human health: the Eco-Health Relationship Browser", October 2013, International Journal of Public Health, Volume 58, Issue, 5, pp 747 – 755: DOI 10.1007/s00038-013-0482-1). The **Eco-Health Relationship Browser** is located on the EPA's ***EnviroAtlas*** website (https://www.epa.gov/enviroatlas).

SCOPE:

Scope of Work/Technical Direction. The EPA Work Assignment Contract Officer Representative (**WACOR**) will identify specific Work Assignment (**WA**) deliverables, their corresponding delivery dates, and will provide technical direction regarding the tasks/subtasks of the **WA** in the sections listed below. The **EPA WACOR** will supplement the technical direction provided in this scope of work with clarifying directives provided primarily through written technical direction. Any verbal technical direction provided by the **EPA WACOR** to the contractor/sub-contractor

will be followed by subsequent written (e.g., e-mail, facsimile, memo, letter, etc.) technical direction from the **EPA WACOR**. The **EPA WACOR** will provide copies of all technical direction to the Contract Level Contract Officer Representative (**CLCOR**), alternate/deputy **CLCOR**, and other EPA personnel as applicable. The contractor/sub-contractor shall maintain a file of all written and verbal technical direction received from the EPA **WACOR** under this **WA**. The technical direction provided by the **EPA WACOR** under this **WA** shall apply to each task and subtask element in this **WA**. The contractor/sub-contractor shall not initiate action on any portion of this **WA** without prior written approval (e.g., e-mail, facsimile, memo, letter, etc., containing technical direction) from the EPA **WACOR**. The contractor/sub-contractor shall utilize the Category III (3) Workplan-Quality Assurance Project Plan (**QAPP**) developed under EPA Contract EP-D-11-060, Work Assignment #34 (Effective Date: 25 June 2015; Final Approval: 24 September 2015) as the initial **QAPP** for implementing this work assignment. The contractor/sub-contractor shall complete the **MSSB Development QAPP-1J16-010.R1**, Revision 1, July 11, 2016, 35 pages, by incorporating the comments from the SED Quality Assurance (**QA**) Manager and the **EPA WACOR** through the technical direction provided by the **EPA WACOR**. The contractor/sub-contractor shall incorporate the **SED** Software Development QA Guidance Document (**SED_Software_Development_QA_Guidance_2a.pdf**) into its Workplan-Design Document/Software Development **QAPP**.

Resources Provided for/Utilized for Work Assignment. The contractor/sub-contractor shall use the following resources provided by the **EPA WACOR** to complete the **MSSB**: **a)** the **MSSB** JavaScript source code; **b)** written technical direction (e.g., e-mails [primarily]); **c)** Microsoft Excel Spreadsheets; **d)** text for the **MSSB** displays; **e) Transportation Report** - Transportation Synthesis Paper - Final Submission 20130926.pdf; **f) Buildings and Infrastructure Report** - B&I Synthesis Report SHC 4 1 1_final.pdf; **g) Materials Management**/Municipal Solid Waste [**MSW**] **Report** - Materials_Management_White_Paper_Sept4_2012.pdf; **h) Land Use Report** - LU short and recommendations 011614.docx and FY13 Product NHEERL 4121 Land_Use_Synthesis.pdf [two separate documents]; **i)** the **SED** Software Development QA Guidance Document (**SED_Software_Development_QA_Guidance_2a.pdf**); **j)** the Category III (3) Workplan-Quality Assurance Project Plan (**QAPP**) developed under EPA Contract EP-D-11-060, Work Assignment #34 (Effective Date: 25 June 2015; Final Approval: 24 September 2015); **k)** the **MSSB Development QAPP-1J16-010.R1**, Revision 1, July 11, 2016, 35 pages; **l)** the draft **MSSB** User Manual, and the draft **MSSB** journal article, and; **m)** other applicable Microsoft Word documents, and *.pdf documents [as required]) provided to complete the **MSSB**.

WA #1-116 Status and Amendment Details:
This Performance Statement of Work (**SOW**) amends the Performance Statement of Work (**SOW**) approved by the EPA Contracts Office on 12 May 2016. The status of the **SOW** approved by the EPA Contracts Office on 12 May 2016 is as follows:

Task 1 through Task 10 (inclusive): ***Complete***
Task 11 – part a through part ll (inclusive): ***Complete*** (but amended in this **SOW**)
Task 12: ***Incomplete*** (amended in this **SOW**)
Task 13: ***Incomplete*** (amended in this **SOW**)
Task 14: ***Complete***
Task 15: ***Incomplete*** (amended in this **SOW**)
Task 16: ***Incomplete*** (amended in this **SOW**)
Task 17: ***Incomplete*** (amended in this **SOW**)
Task 18: ***Incomplete*** (amended in this **SOW**)
Task 19: ***Incomplete*** (amended in this **SOW**)
Task 20: ***Incomplete*** (amended in this **SOW**)
Schedule of Deliverables: ***Incomplete*** (amended in this **SOW**)

This **SOW** amends the **SOW** approved by the EPA Contracts Office on 12 May 2016 as follows:

Removes Tasks 1 through 20 (inclusive) and adds Tasks 1 through 16 (inclusive)
Task 8 in this **SOW** amends/modifies/updates Task 11 in the 12 May 2016 **SOW.**
Task 8 in this **SOW** amends/modifies/updates Task 12 in the 12 May 2016 **SOW.**
Task 10 in this **SOW** amends/modifies/updates Task 13 in the 12 May 2016 **SOW.**
Task 6 in this **SOW** amends/modifies/updates Task 15 in the 12 May 2016 **SOW.**
Task 12 in this **SOW** amends/modifies/updates Task 16 in the 12 May 2016 **SOW.**
Task 13 in this **SOW** amends/modifies/updates Task 17 in the 12 May 2016 **SOW.**
Task 14 in this **SOW** amends/modifies/updates Task 18 in the 12 May 2016 **SOW.**
Task 15 in this **SOW** amends/modifies/updates Task 19 in the 12 May 2016 **SOW.**
Task 16 in this **SOW** amends/modifies/updates Task 20 in the 12 May 2016 **SOW.**
The Schedule of Deliverables in this **SOW** amends/modifies/updates the Schedule of Deliverables in the 12 May 2016 **SOW.**

The **EPA WACOR** will provide technical direction for implementing the amendments to this **SOW.**

TECHNICAL APROACH/OBJECTIVES:
The following individual tasks and subtasks shown below are required to complete the **MSSB,** using the current version of the **MSSB** JavaScript source code, associated code, and related resources as the basis for continued **MSSB** development. The contractor/sub-contractor shall complete each task and subtask activity listed below, and shall consult the **EPA WACOR** for explicit technical direction in the accomplishment of each task. The contractor/sub-contractor shall

also complete the **MSSB** User Manual and the **MSSB** journal article manuscript, using the current versions of each document provided by the **EPA WACOR**. **Note:** The **EPA WACOR** strongly *recommends* the use of Oneida Total Integrated Enterprises (**OTIE**) as the subcontractor for this work assignment, based on **OTIE's** development of the **MSSB** and its familiarity with the software development, the software testing, and the software quality assurance requirements of the **MSSB**.

Task 0 (**Administrative Task**)
This task is only to be utilized for completion of work on **MSSB** design, documentation, coding, code testing, code maintenance, and project management activities occurring prior to 31 Aug 2016. The **EPA WACOR** will provide explicit technical direction for this task.

Task 1 - **'Broken' Weblinks *in Text Boxes***: The weblinks provided below include a punctuation mark (period [.] or comma [,]) at the end of the weblink, or are the incorrect/previous version of the weblink. This causes a 'page not found' error. The correct/valid/operational/working weblink is provided in each case shown below. **(Twenty [20] instances)**

a. ***Human Well-Being*** (Text box) – Change "http://www.cdc.gov/transportation/default.htmExit" to "http://www.cdc.gov/transportation/default.htm"; Ensure that the **'Exit'** marker is properly placed behind this weblink and not joined to it.

b. ***Vehicle Electrification and Related Infrastructure*** (Text box) - Change "http://www.afdc.energy.gov/locator/stations/Exit" to "http://www.afdc.energy.gov/locator/stations/"; Place "**).**" immediately after end of weblink; Ensure that the **'Exit'** marker is properly placed behind this weblink and not joined to it.

c. ***Alternative and Renewable Fuels*** (Text box) - Change "www.afdc.energy.gov/locator/stations/Exit" to "http://www.afdc.energy.gov/locator/stations/"; Place "**.**" immediately after end of weblink; Ensure that the **'Exit'** marker is properly placed behind this weblink and not joined to it.

d. ***Alternative and Renewable Fuels*** (Text box) - Change "http://www.afdc.energy.gov/fuels/" to "http://www.afdc.energy.gov/locator/stations/"; Ensure that the **'Exit'** marker is properly placed behind this weblink and not joined to it.

e. ***Alternative and Renewable Fuels*** (Text box) – Change "www.afdc.energy.gov/case" to "http://www.afdc.energy.gov/case"; Ensure

that the '**Exit**' marker is properly placed behind this weblink and not joined to it.

f. ***Economic Analysis Software for Transportation Planning*** (Text box) – Change "http://ops.fhwa.dot.gov/trafficanalysistools/tat_vol2/sectapp_e.htm." to "http://ops.fhwa.dot.gov/trafficanalysistools/tat_vol2/sectapp_e.htm"; Ensure that the '**Exit**' marker is properly placed behind this weblink and not joined to it.

g. ***Economic Analysis Software for Transportation Planning*** (Text box) – Change "http://www.ctre.iastate.edu/research/enhance/Zip/FinalAV.PDF." to "http://www.ctre.iastate.edu/research/enhance/Zip/FinalAV.PDF"; Ensure that the '**Exit**' marker is properly placed behind this weblink and not joined to it.

h. ***Specific Resources and Tools for Determining Air Quality Outcomes*** (Text box) – Change "http://epa.gov/ttn/chief/emch/2007v5/2007v5_2020base_EmisMod_TSD_13dec2012.pdf." to "https://www.epa.gov/air-emissions-modeling/air-emissions-modeling-resources"; Ensure that the '**Exit**' marker is properly placed behind this weblink and not joined to it.

i. ***Specific Resources and Tools for Determining Air Quality Outcomes*** (Text box) – Change "http://www.epa.gov/otaq/models/moves/index.htm) and hourly meteorology" to "https://www.epa.gov/air-emissions-modeling"; Ensure that the '**Exit**' marker is properly placed behind this weblink and not joined to it.

j. ***Specific Resources and Tools for Determining Air Quality Outcomes*** (Text box) – Change "http://www.arb.ca.gov/msei/categories.htm." to "http://www.arb.ca.gov/msei/categories.htm"; Ensure that the '**Exit**' marker is properly placed behind this weblink and not joined to it.

k. ***Specific Resources and Tools for Determining Air Quality Outcomes*** (Text box) – Change "www.epa.gov/otaq/stateresources/tools.htm." to "https://www3.epa.gov/otaq/models/moves/"; Ensure that the '**Exit**' marker is properly placed behind this weblink and not joined to it.

l. ***Specific Resources and Tools for Determining Air Quality Outcomes*** (Text box) – Change "www.epa.gov/otaq/stateresources/policy/pag_transp.htm" to "https://www.epa.gov/state-and-local-transportation"; Ensure that the '**Exit**' marker is properly placed behind this weblink and not joined to it.

m. ***Specific Resources and Tools for Determining Air Quality Outcomes*** (Text box) – Change "www.epa.gov/otaq/stateresources/ghgtravel.htm" to "https://www.epa.gov/state-and-local-transportation/estimating-road-greenhouse-gas-emissions"; Ensure that the '**Exit**' marker is properly placed behind this weblink and not joined to it.

n. ***Specific Resources and Tools for Determining Air Quality Outcomes*** (Text box) – Change "http://www.epa.gov/otaq/stateresources/transconf/projectlevel-hotspot.htm" to "https://www.epa.gov/state-and-local-transportation/project-level-conformity-and-hot-spot-analyses"; Ensure that the '**Exit**' marker is properly placed behind this weblink and not joined to it.

o. ***Specific Resources and Tools for Determining Air Quality Outcomes*** (Text box) – Change "http://www.epa.gov/vaporintrusion," to "http://www.epa.gov/vaporintrusion"; Ensure that the '**Exit**' marker is properly placed behind this weblink and not joined to it.

p. ***Traditional Neighborhood Development*** (Text box) – Change "https://profile.usgs.gov/myscience/upload_folder/ci2014Nov2612035472345Russell%20et%20al.%202013-%20Neighborhood%20scalle%20quantification%20of%20ecosystem%20goods%20and%20services.pdf." to "https://profile.usgs.gov/myscience/upload_folder/ci2014Nov2612035472345Russell%20et%20al.%202013-%20Neighborhood%20scalle%20quantification%20of%20ecosystem%20goods%20and%20services.pdf"; Ensure that the '**Exit**' marker is properly placed behind this weblink and not joined to it.

q. ***Special Journal Issue of the American Journal of Public Health*** (Text box) – Change "http://ajph.aphapublications.org/toc/ajph/101/S1." to "http://ajph.aphapublications.org/toc/ajph/101/S1"; Ensure that the '**Exit**' marker is properly placed behind this weblink and not joined to it.

r. ***Review of Health Impact Assessments (HIAs)*** (Text box) – Change "http://ajph.aphapublications.org/toc/ajph/101/S1." to "http://ajph.aphapublications.org/toc/ajph/101/S1"; Ensure that the '**Exit**' marker is properly placed behind this weblink and not joined to it.

s. ***Reports on Lakes, Coastal Areas, and Bird Species*** (Text box) – Change "http://intranet.ord.epa.gov/sites/default/files/media/SHC-Products/Sierszen%20et%20al.%202012%20AEHMS.pdf." to "http://intranet.ord.epa.gov/sites/default/files/media/SHC-Products/Sierszen%20et%20al.%202012%20AEHMS.pdf"; Ensure that the '**Exit**' marker is properly placed behind this weblink and not joined to it.

t. ***Report on Neighborhood-Scale Quantification of Ecosystem Goods and Services*** (Text box) – Change "https://profile.usgs.gov/myscience/upload_folder/ci2014Nov2612035472345Russell%20et%20al.%202013-%20Neighborhood%20scalle%20quantification%20of%20ecosystem%20goods%20and%20services.pdf." to "https://profile.usgs.gov/myscience/upload_folder/ci2014Nov2612035472345Russell%20et%20al.%202013-%20Neighborhood%20scalle%20quantification%20of%20ecosystem%20goods%20and%20services.pdf"; Ensure that the **'Exit'** marker is properly placed behind this weblink and not joined to it.

Task 2 - **Extra References**: In each case shown below, there are duplicate references. (**Seventeen [17] instances**)

a. ***Intersection Density*** (Text box) – Remove the second "Ewing, R., et al., (2010)" weblink/reference.

b. ***Social Determinants of Health*** (Text box) – Remove the second "Christian, T.J., (2012)" weblink/reference.

c. ***Walking for Transportation*** (Text box) – Remove the second "Ewing, R., et al., (2010)" weblink/reference.

d. ***Accessibility By Auto*** (Text box) – Remove the second "Ewing, R., et al., (2010)" weblink/reference.

e. ***Traffic Safety*** (Text box) – Remove the second "Kaczynski, A.T., et al., (2010)" weblink/reference.

f. ***Transit Use*** (Text box) – Remove the second "Ewing, R., et al., (2010)" weblink/reference.

g. ***Traffic Congestion*** (Text box) – Remove the second "Ewing, R., et al., (2010)" weblink/reference.

h. ***Social Capital*** (Text box) – Remove the second "Kaczynski, A.T., et al., (2010)" weblink/reference; Remove second "Christian, T.J., et al., (2012)" weblink/reference.

i. ***Job Accessibility by Auto*** (Text box) – Remove the second "Ewing, R., et al., (2010)" weblink/reference.

j. ***Transit Use*** (Text box) – Remove the second "Ewing, R., et al., (2010)" weblink/reference.

k. ***Less Driving – Vehicle Miles Travelled*** (Text box) – Remove the second "Ewing, R., et al., (2010)" weblink/reference.

l. ***Shorter Commute Time*** (Text box) – Remove the second "Christian, T.J., et al., (2012)" weblink/reference.

m. ***What Regional Scale Land Use Qualities Are Most Important For Advancing Sustainability?*** (Text box) – Remove the second "Christian, T.J., et al., (2012)" weblink/reference.

n. ***Transit Stops*** (Text box) – Remove the second "Ewing, R., et al., (2010)" weblink/reference.

o. ***What Neighborhood Scale Land Use Qualities Are Most Important for Advancing Sustainability?*** (Text box) – Remove the second "Christian, T.J., et al., (2012)" weblink/reference.

p. ***Street Intersection Density*** (Text box) – Remove the second "Ewing, R., et al., (2010)" weblink/reference.

q. ***Accessibility, Travel Time, and Social Interaction*** (Text box) – Remove the second "Christian, T.J., et al., (2012)" weblink/reference.

Task 3 **- Lower Obesity/Body Mass Index (BMI)** (Text box - ***thumbnail picture***): This is an issue for ***Internet Explorer*** and ***Firefox*** web browsers only. When the thumbnail is selected in these two browsers, the picture fills the entire screen and only a portion of the full picture can be seen. The **Opera** and **Google Chrome** web browsers deploy scroll bars that allow the user to view the full picture. (**One [1] instance**)

a. ***Lower Obesity/Body Mass Index (BMI)*** (Text box) – The thumbnail picture, when selected in the ***Internet Explorer*** and ***Firefox*** web browsers, fills the entire screen. Only a portion of the full picture can be seen. Either the size of the picture resulting from the thumbnail should be reduced, or deploy scroll bars in the ***Internet Explorer*** and ***Firefox*** web browsers so that the full graphic can be seen.

Task 4 **- Misspelled Word**: In the display where 'Commercial' links to 'Best Practices and Unintended Consequences', the word "dev3elopers" should be changed to "developers" in the text box. (**One [1] instance**)

a. **Commercial** - Linkage to "Best Practices and Unintended Consequences" (***Text box***): Under the 'Walkable' section, change "dev3elopers" to "developers".

Task 5 **- Misspelled Word:** All instances of 'Travelled' or 'travelled' in **MSSB** should be changed to 'Traveled' or 'traveled'. **(Multiple instances)**

Task 6 **- Incorrect Label:** The weblink in the Land Use Main Display (linking to the Land Use Report) works as it should, but the name of link should be changed from 'Transportation Synthesis Document' to 'Land Use Report Document'. **(One [1] instance)**

a. **Land Use** (***Main Display***) – The 'dummy' placeholder (i.e., weblink) for the Land Use Report **works**, but ***change the name of link*** from 'Transportation Synthesis Document' to 'Land Use Report Document'.

b. **Sustainability (Main Display)** – provide a 'dummy' placeholder (i.e., weblink) to accommodate the **MSSB User Manual.**

Task 7 **- 'Broken' Weblinks** ***in Link Text/Text Boxes***: The weblinks provided below include a punctuation mark (period [.] or comma [,]) at the end of the weblink, or are the incorrect/previous version of the weblink. This causes a 'page not found' error. The correct/valid/operational/working weblink is provided in each case shown below. **(Thirteen [13] instances)**

a. ***Human Well-Being*** (Link text/text box with ***Transportation***) – Change "http://www.cdc.gov/transportation/default.htm." to "http://www.cdc.gov/transportation/default.htm"; Ensure that the **'Exit'** marker is properly placed behind this weblink and not joined to it.

b. ***Economic Analysis Software for Transportation Planning*** (Link text/text box with ***Economic Issues***) – Change "http://ops.fhwa.dot.gov/trafficanalysistools/tat_vol2/sectapp_e.htm." to "http://ops.fhwa.dot.gov/trafficanalysistools/tat_vol2/sectapp_e.htm"; Ensure that the **'Exit'** marker is properly placed behind this weblink and not joined to it.

c. ***Economic Analysis Software for Transportation Planning*** (Link text/text box with ***Economic Issues***) – Change "http://www.ctre.iastate.edu/research/enhance/Zip/FinalAV.PDF." to "http://www.ctre.iastate.edu/research/enhance/Zip/FinalAV.PDF"; Ensure

that the '**Exit**' marker is properly placed behind this weblink and not joined to it.

d. ***Specific Resources and Tools for Determining Air Quality Outcomes*** (Link text/text box with ***Air Quality***) – Change "http://epa.gov/ttn/chief/emch/2007v5/2007v5_2020base_EmisMod_TSD_13dec2012.pdf." to "https://www.epa.gov/air-emissions-modeling/air-emissions-modeling-resources"; Ensure that the '**Exit**' marker is properly placed behind this weblink and not joined to it.

e. ***Specific Resources and Tools for Determining Air Quality Outcomes*** (Link text/text box with ***Air Quality***) – Change "http://www.arb.ca.gov/msei/categories.htm." to "http://www.arb.ca.gov/msei/categories.htm"; Ensure that the '**Exit**' marker is properly placed behind this weblink and not joined to it.

f. ***Specific Resources and Tools for Determining Air Quality Outcomes*** (Link text/text box with ***Air Quality***) – Change "www.epa.gov/otaq/stateresources/tools.htm." to "https://www3.epa.gov/otaq/models/moves/"; Ensure that the '**Exit**' marker is properly placed behind this weblink and not joined to it.

g. ***Specific Resources and Tools for Determining Air Quality Outcomes*** (Link text/text box with ***Air Quality***) – Change "www.epa.gov/otaq/stateresources/policy/pag_transp.htm" to "https://www.epa.gov/state-and-local-transportation"; Ensure that the '**Exit**' marker is properly placed behind this weblink and not joined to it.

h. ***Specific Resources and Tools for Determining Air Quality Outcomes*** (Link text/text box with ***Air Quality***) – Change "www.epa.gov/otaq/stateresources/ghgtravel.htm" to "https://www.epa.gov/state-and-local-transportation/estimating-road-greenhouse-gas-emissions"; Ensure that the '**Exit**' marker is properly placed behind this weblink and not joined to it.

i. ***Specific Resources and Tools for Determining Air Quality Outcomes*** (Link text/text box with ***Air Quality***) – Change "http://www.epa.gov/otaq/stateresources/transconf/projectlevel-hotspot.htm" to "https://www.epa.gov/state-and-local-transportation/project-level-conformity-and-hot-spot-analyses"; Ensure that the '**Exit**' marker is properly placed behind this weblink and not joined to it.

j. ***Special Journal Issue of the American Journal of Public Health*** (Link text/text box with ***ORD Recent and Planned Products Relevant to Land Use Decisions and Sustainability***) – Change

"http://ajph.aphapublications.org/toc/ajph/101/S1." to "http://ajph.aphapublications.org/toc/ajph/101/S1"; Ensure that the **'Exit'** marker is properly placed behind this weblink and not joined to it.

k. ***Review of Health Impact Assessments (HIAs)*** (Link text/text box with ***ORD Recent and Planned Products Relevant to Land Use Decisions and Sustainability***) – Change "http://ajph.aphapublications.org/toc/ajph/101/S1." to "http://ajph.aphapublications.org/toc/ajph/101/S1"; Ensure that the **'Exit'** marker is properly placed behind this weblink and not joined to it.

l. ***Reports on Lakes, Coastal Areas, and Bird Species*** (Link text/text box with ***ORD Recent and Planned Products Relevant to Land Use Decisions and Sustainability***) – Change "http://intranet.ord.epa.gov/sites/default/files/media/SHC-Products/Sierszen%20et%20al.%202012%20AEHMS.pdf." to "http://intranet.ord.epa.gov/sites/default/files/media/SHC-Products/Sierszen%20et%20al.%202012%20AEHMS.pdf"; Ensure that the **'Exit'** marker is properly placed behind this weblink and not joined to it.

m. ***Report on Neighborhood-Scale Quantification of Ecosystem Goods and Services*** (Link text/text box with ***ORD Recent and Planned Products Relevant to Land Use Decisions and Sustainability***) – Change "https://profile.usgs.gov/myscience/upload_folder/ci2014Nov2612035472345Russell%20et%20al.%202013-%20Neighborhood%20scalle%20quantification%20of%20ecosystem%20goods%20and%20services.pdf." to "https://profile.usgs.gov/myscience/upload_folder/ci2014Nov2612035472345Russell%20et%20al.%202013-%20Neighborhood%20scalle%20quantification%20of%20ecosystem%20goods%20and%20services.pdf"; Ensure that the **'Exit'** marker is properly placed behind this weblink and not joined to it.

Task 8 **- Missing Links and Link Text**: There are **seven (7) instances** of missing links and the associated link text, which affects child nodes 500 – 514 inclusively, and the respective parent nodes (7, 12, 26, 33, 46, 51, 55, 67, 70, 80, 87, 92, 95, 105, and 109). The last item in the list requires link text, which is provided below.

a. ***Quantitative Relations for Agricultural Uses*** (Link and link text box) – The **link and associated link text** is not displayed between ***Quantitative Relations for Agricultural Uses*** and ***Agriculture***.

b. ***Quantitative Relations for Commercial Uses*** (Link and link text box) – The **link and associated link text** is not displayed between ***Quantitative Relations for Commercial Uses*** and ***Commercial***.

c. ***Quantitative Relations for Industrial Uses*** (Link and link text box) – The **link and associated link text** is not displayed between ***Quantitative Relations for Industrial Uses*** and ***Industrial***.

d. ***Quantitative Relations for Parkland*** (Link and link text box) – The **link and associated link text** is not displayed between ***Quantitative Relations for Parkland*** and ***Parkland and Open Space***.

e. ***Quantitative Relations for Residential Uses*** (Link and link text box) – The **link and associated link text** is not displayed between ***Quantitative Relations for Residential Uses*** and ***Residential***.

f. ***Quantitative Relations for Road*** (Link and link text box) – The **link and associated link text** is not displayed between ***Quantitative Relations for Road*** and ***Roads***.

g. ***Quantitative Relations for Compact Development*** (Link and link text box) – The **link and associated link text** is not displayed between ***Quantitative Relations for Compact Development*** and ***Compact Development Pattern***.

The following is to be ***used as the link text***:
"The compact development pattern is generally explained or described in terms of the 'smallness' of its land use 'footprint'. This can be illustrated by indicating how much land is being used as compared to more extensive land use approaches. There are other measures that are used when discussing compact developments. Developments of this type located in centralized urban areas tend to affect travel behavior (e.g., less driving by residents, more walking, etc.). The influence of this type of development can be measured in a number of ways, but any measurements of the impact of compact developments should always provide an idea of how sustainability goals, activities, and objectives are (or are not) supported."

Task 9 **- Drop-Down Menu Items**: There are **five (5) instances** where letters of words in the drop-down menu require capitalization. **Drop-Down Menu:** The following items require capitalization as shown below:

a. 'Energy Used to treat water' should be 'Energy Used to Treat Water'

b. 'Green Infrastructure and drinking water' should be 'Green Infrastructure and Drinking Water'

c. 'Agriculture, Water quality, and Hydrology' should be 'Agriculture, Water Quality, and Hydrology'

d. 'Impervious Surfaces and Compact development' should be 'Impervious Surfaces and Compact Development'

e. 'Cumulative environmental hazard inequality index' should be 'Cumulative Environmental Hazard Inequality Index'

Task 10* - References**: There are **two (2) instances** where references require that the correct information is added into the appropriate display(s)/node(s) in MSSB, and in the ***Quant_Rel_Nodes_To_Don_071116.xlsx spreadsheet.

a. The following information will complete the missing "???" citation number data in the ***Quant_Rel_Nodes_To_Don_071116.xlsx*** spreadsheet. The **citation number** ('CitationNumber') required for the **Litman, 2012** citation in the ***Quant_Rel_Nodes_To_Don_071116.xlsx*** spreadsheet is **171**. That information is obtained from the ***LandUseCitations.xlsx*** spreadsheet.

b. The **Sinha, 2003** citation ***does not have a citation number assigned*** in the ***LandUseCitations.xlsx*** spreadsheet. Since the last citation number in the ***LandUseCitations.xlsx*** spreadsheet is 553, the citation number for the **Sinha, 2003** should be assigned the number **554** as its citation number. The full citation information for (**Sinha, 2003**) is as follows:

   Sinha, K., Sustainability and Urban Public Transportation, Journal of Transportation Engineering (American Society of Civil Engineers), July 2003, Vol. 129, No. 4, pp. 331-341, DOI: 10.1061/(ASCE)0733-947X(2003)129:4(331); **Permalink:** http://dx.doi.org/10.1061/(ASCE)0733-947X(2003)129:4(331)

The citation information for the **Sinha, 2003** citation was validated/verified on 24 Aug 2016.

Task 11 (**Editing Task**)
The **EPA WACOR** may require changes to text in the Land Use (or other) portion of the **MSSB** displays due to editorial comments received from internal EPA reviewers. These are anticipated to be minor editorial changes and the **EPA WACOR** will provide explicit technical direction for this task.

Task 12 (**Technical Direction**)
The **EPA** Work Assignment Contract Officer Representative (**WACOR**) will identify specific Work Assignment (**WA**) deliverables, and their corresponding delivery dates, in the ***Deliverables*** and ***Schedule of Deliverables*** Sections of this document. The **EPA WACOR** will provide technical direction regarding the tasks/subtasks of this **WA**. The **EPA WACOR** will supplement the technical direction provided in this scope of work with clarifying directives (e.g., **i)** implementing implied requirements which support/complete the explicitly stated requirements specified in this scope of work; **ii)** how to complete the **MSSB** User Manual and the **MSSB** journal article manuscript to properly document and describe **MSSB** design, behavior, and operational principles; **iii)** integration of the **MSSB** onto the EPA ***EnviroAtlas*** website [https://www.epa.gov/enviroatlas], etc.), provided primarily through written technical direction e-mails. The **EPA** Work Assignment Contract Officer Representative (**WACOR**) may prioritize the order of completion of tasks/sub-tasks in the work assignment as applicable.

Any verbal technical direction provided by the **EPA WACOR** to the contractor/sub-contractor will be followed by subsequent written (e.g., e-mail, facsimile, memo, letter, etc.) technical direction. The contractor/sub-contractor shall maintain a file of all written and verbal technical direction received from the **EPA WACOR** under this **WA**. The technical direction provided by the **EPA WACOR** under this **WA** shall apply to each task and subtask element in this **WA**. The contractor/sub-contractor shall provide general support, to include maintaining the Amazon Web Service (**AWS**) website (http://54.161.236.169/), which hosts the version of the **MSSB**, used for peer-review analysis, operational testing, and integration testing, required to develop and deliver each **WA** deliverable to the **EPA WACOR**.

The contractor/sub-contractor shall not initiate action on any portion of this **WA** without prior written approval (e.g., e-mail, facsimile, memo, letter, etc., including technical direction) from the **EPA WACOR**. The contractor/sub-contractor shall not be required to travel during the period of performance of this **WA**. Any non-local travel directly chargeable to this **WA** shall be submitted to and approved by the **EPA WACOR** prior to the travel. The contractor/sub-contractor's Workplan-Design Document/Software Development **QAPP** must be approved by the **EPA WACOR** before any activity is initiated on this **WA**.

Task 13 (**Prepare monthly progress reports, task/subtask estimates, weekly status reports, and attend weekly teleconference meetings with the EPA WACOR**)

The contractor/sub-contractor shall prepare and submit monthly progress reports, including monthly costs and manhour expenditures in electronic format, to the **EPA WACOR** for review and approval. The contractor/sub-contractor shall prepare and submit task/subtask estimates in the Workplan-Design Document/Software Development **QAPP**, as indicated, in ***Task AA*** of this work assignment. The contractor/sub-contractor shall prepare and submit weekly written status reports in electronic format to the **EPA WACOR** before each weekly teleconference meeting. The contractor/sub-contractor shall also prepare written summaries of conference calls/teleconference meetings with the **EPA WACOR** in electronic format. The weekly status report shall contain as a minimum: **(a)** the status of the Land Use, Buildings/Infrastructure, Transportation, Materials Management (**MSSB**) software code generation/modification/maintenance activities (e.g., analysis/code/test, etc.); **(b)** the status of the **MSSB** document development activities (i.e., **MSSB** User Manual and **MSSB** journal article manuscript, which document the **MSSB** design and operational behavior); **(c)** the number of man-hours expended on each task during the week [including **(a)** and **(b)** above]; **(d)** the status of work assignment deliverables (e.g., source code, documents [**MSSB** User Manual and **MSSB** journal article manuscript], etc.) for each work assignment task and/or work assignment subtask; **(e)** the current amount of funds expended based on **(a)**, **(b)**, **(c)**, and **(d)**.

The **EPA WACOR** will designate a consistent day and time for each weekly teleconference meeting and will notify the contractor/sub-contractor of the scheduled day for each teleconference meeting upon award of the work assignment and approval of the contractor/sub-contractor's Workplan-Design Document/Software Development **QAPP** by the **EPA WACOR**. The **EPA WACOR** reserves the right to change the day of the weekly teleconference meeting or cancel it when required. If the **EPA WACOR** travels to the contractor/sub-contractor location during the period of this work assignment, the **EPA WACOR** visit(s) will substitute for the regularly scheduled weekly teleconference meeting. The **EPA WACOR** will provide technical direction during the weekly teleconference meetings. Technical direction will also be provided through e-mails, facsimiles, memos, letters, etc., and through periodic site visits to the contractor/sub-contractor's location as applicable.

QUALITY ASSURANCE:

Task 14 (***Include and Implement Work Assignment Quality Assurance Requirements in Workplan-Design Document/Software Development QAPP***)

The contractor/sub-contractor shall incorporate the entire **SED** Software Development QA Guidance Document (**SED_Software_Development_QA_Guidance_2a.pdf**) by reference into the Workplan-Design Document/Software Development **QAPP** it develops and submits to the **EPA WACOR** for this work assignment. The contractor/sub-contractor shall implement the required software quality assurance and quality control (**QA/QC**) provisions in the **SED** Software Development QA Guidance Document (as incorporated into the Workplan-Design Document/Software Development **QAPP**) into the activities of this work assignment during the period of performance of this work assignment. The contractor/sub-contractor shall use the Category III (3) Workplan-Quality Assurance Project Plan (**QAPP**) developed under EPA Contract EP-D-11-060, Work Assignment #34 (Effective Date: 25 June 2015; Final Approval: 24 September 2015) and the **MSSB Development QAPP-1J16-010.R1**, Revision 1, July 11, 2016, 35 pages, as the basis of the Workplan-Quality Assurance Project Plan (**QAPP**) submitted under this work assignment. The **MSSB Development QAPP-1J16-010.R1**, Revision 1, July 11, 2016, 35 pages (signed by the **EPA WACOR** on 14 July 2016), shall be modified as indicated in the e-mail from the **EPA WACOR** dated 31 Aug 2016 (12:19PM). Table 2-1 and Table 2-2 in the **MSSB Development QAPP-1J16-010.R1**, Revision 1, July 11, 2016, 35 pages (signed by the **EPA WACOR** on 14 July 2016), shall be revised based on the tasks in this **SOW**.

Task 15 (Deliver Workplan-Design Document/Software Development QAPP {Quality Assurance Project Plan} for Work Assignment to the EPA WACOR)

The contractor/sub-contractor shall prepare and deliver a Workplan-Design Document/Software Development **QAPP** to address the completion of each task and subtask in this work assignment no later than (**NLT**) **10 *calendar* days** after award of this work assignment. The Workplan-Design Document/Software Development **QAPP** shall include as a minimum a cost estimate (i.e., dollars and man-hours), and shall be structured by work assignment task and subtask (where applicable), along with a description of the required activities to complete each task and subtask (where applicable) of this work assignment. The contractor/sub-contractor shall provide a list of all software used in the modification, testing, and integration of the **MSSB** code base (e.g., JavaScript, D3.js, JSON, HTML, XML, etc.), and shall describe and specify each type of software used in all work assignment tasks/subtasks/activities (e.g., build software, configuration management software, link/load software, compiler, interpreter, (e.g., **JVM** – Java Virtual Machine), module test/system test software, database software, etc.). The Workplan-Design Document/Software Development **QAPP** shall include information on the organization of the file and directory structure of the **MSSB** code, and information on how the **MSSB** code should be integrated into the EPA ***EnviroAtlas*** website. The contractor/sub-contractor shall adhere to the software **QA/QC** requirements as delineated in this statement of work. Work shall not commence

until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff. The **MSSB** is an EPA Category III (3) scientific product, with corresponding **QA/QC** requirements.

DELIVERABLES:

Task 16 **(Deliver Completed MSSB Source Code, Executable/Operational Code, and Documentation to the EPA WACOR)**

The contractor/sub-contractor shall complete the **MSSB** software source code, executable/operational code, and its associated documentation (e.g., **MSSB** User Manual [input], **MSSB** journal article manuscript [input], Workplan-Design Document/Software Development **QAPP** [including browser software test and quality assurance/**QAPP** provisions], source code listings (*including comments in the **MSSB** source code to support and enhance readability for current and future **MSSB** code maintenance*), progress/status reports, etc. [in electronic format]), as directed in the tasks and subtasks of this work assignment. The Workplan-Design Document/Software Development **QAPP** (including browser software test and quality assurance/**QAPP** provisions, and including provisions for *comments in the **MSSB** source code to support and enhance readability for current and future **MSSB** code maintenance*) shall be delivered to the **EPA WACOR** no later than (**NLT**) ***7 calendar days after the formal award of this work assignment***, as shown in the delivery schedule provided below. During this contract work assignment, the contractor/sub-contractor shall deliver interim versions of the **MSSB** software source code, and executable code to the **EPA WACOR** on a periodic (e.g., weekly, bi-weekly, or monthly) basis for the **EPA WACOR** to review and to provide technical direction on any further **MSSB** source code maintenance or **MSSB** source code modifications that may be required. Upon completion of **MSSB** software source code modifications and the **MSSB** document (**MSSB** User Manual and **MSSB** journal article) modifications/revisions, the contractor/sub-contractor shall deliver the following to the **EPA WACOR** upon the conclusion of this work assignment: **(a)** final version of the complete (modified) **MSSB** software source code, compatible with the Windows 7 Operating System (loaded onto CD-ROM[s]/DVD[s]/memory stick(s)); **(b)** final version of the complete (modified) **MSSB** software executable code, compatible with the Windows 7 Operating System (loaded onto CD-ROM[s]/DVD[s]/memory stick(s)); **(c)** final version of the complete (modified) **MSSB** documentation (e.g., **MSSB** User Manual, **MSSB** journal article manuscript, Workplan-Design Document/Software Development **QAPP** [including browser software test and quality assurance/**QAPP** provisions and provisions for *comments in the **MSSB** source code to support and enhance readability for current and future **MSSB** code maintenance*]), (loaded onto CD-ROM[s]/DVD[s]/memory stick(s)). **Note:** Delivery of **(a)**, **(b)**, and **(c)** by File Transfer Protocol (**FTP**), and subsequent download by **EPA WACOR**, is acceptable.

The contractor/sub-contractor shall deliver: **a)** the final **MSSB** software source code, compatible with Windows 7 32-bit and 64-bit Operating System versions; **b)** the final **MSSB** software executable code, compatible with Windows 7 32-bit and 64-bit Operating System versions, and; **c)** the **MSSB** documentation (i.e., **MSSB** User Manual [input] and **MSSB** journal article manuscript [input]) to the **EPA WACOR** no later than (**NLT**) ***10 business days prior to the final delivery date*** as specified below for this work assignment. The **EPA WACOR** will review **a), b),** and **c)** and will provide technical direction to the contractor/sub-contractor. The contractor/sub-contractor shall incorporate the technical direction from the **EPA WACOR** into the final deliverable version of **a), b),** and **c)**. The contractor/sub-contractor shall deliver the final versions of **a), b),** and **c)** to the **EPA WACOR** NLT **5 business days prior to the final delivery date** as specified below for this work assignment.

SCHEDULE of DELIVERABLES:

All work assignment deliverables shall be delivered in the format(s) as specified in ***Task 15*** and ***Task 16***. Acceptance criteria for all deliverables shall be consistent with the contract-level Statement of Work. **Note: DAC*** – Days Ater Contract/Work Assignment Award Date.

Activity/Deliverable/Milestone	**Delivery Schedule**
Task 12 – Implement General Technical Direction/Provide General Support	On-Going/Continuous
Task 13	
Monthly Progress Reports	Monthly
Weekly Status Reports	Weekly
Teleconference Meetings	Weekly
Task 14/Task *15* – Workplan-Design Document/Software Development **QAPP**	7 **DAC*** (Includes Task/Subtask Estimates)
Task 16 – MSSB Source Code [**Listings**] - Draft Final Version	30 **DAC***
Task 16 – MSSB Executable - Draft Final Version	30 **DAC***
Task 16 – MSSB User Manual - Draft Input	30 **DAC***
Task 16 – MSSB Journal Article - Draft Input	30 **DAC***
Task 16 – MSSB Source Code [**Listings**] - Final Version	45 **DAC***
Task 16 – MSSB Executable - Final Version	45 **DAC***
Task 16 – MSSB User Manual - Final Input	45 **DAC***

Task 16 – MSSB Journal Article - Final Input	45 **DAC***
Final Delivery Date	45 **DAC***

WORK ASSIGNMENT PERIOD OF PERFORMANCE:

The period of performance of this work assignment shall begin on the date that this work assignment is formally awarded (i.e., the date of the Contracting Officer's signature) and shall be completed no later than March 31, 2017. **Note:** This work assignment shall be completed as indicated in the deliverable schedule above. This delivery schedule may be adjusted by the **EPA WACOR** as applicable.

EPA WACOR:

Eric S. Hall
U.S. Environmental Protection Agency (**EPA**)
Office of Research and Development (**ORD**)
National Exposure Research Laboratory (**NERL**)
Systems Exposure Division (**SED**)
109 TW Alexander Drive, MD E205-03
Research Triangle Park, NC 27711-0001
E-Mail: Hall.EricS@epa.gov
Phone: (919) 541-3147
FAX: (919) 541-1551

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-119

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name David Heist	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-1199
			FAX Number:
Project Officer Name Robin Baily	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-7906
			FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code:
			Phone Number:
			FAX Number:
Contracting Official Name Mark Cranley	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-487-2351
			FAX Number: 513-487-2109

Performance Work Statement

WA Title: Fluid Modeling Facility Wind Tunnel Studies

WA #: 1-119 WACOR: David Heist

Contract #: EP-C-15-008 Alternate WACOR: William Benjey

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

The purpose of this work assignment is to support the Fluid Modeling Facility's experimental research of flow and dispersion within the laboratory wind tunnel. Projects include the modeling of building downwash and flow and dispersion around various roadside barrier configurations. The goals are to develop a characterization of dispersion of steady state emissions of pollutants for various source configurations and an examination of the effects of the structures on pollutant dispersion.

BACKGROUND

Air emissions in urban areas and near buildings contribute significantly to overall exposure from air pollutants in many areas of the country. Pollutant monitoring alone cannot provide the temporal and spatial detail generally needed for regulatory work, exposure assessments and health studies. Therefore, air quality models are critical for providing reliable estimates of exposure and risk. The development and evaluation of such models require relevant laboratory and/or field measurements of flow and dispersion in the vicinity of buildings. The EPA's Fluid Modeling Facility has a long history of wind tunnel studies of flow around individual structures and arrays of model buildings and structures and is well suited for developing databases of flow and dispersion for use in model building and testing. The databases generated in this work assignment will be critical to the enhancement of building downwash algorithms noise barrier algorithms.

SCOPE

This task is intended to provide experimental data bases from which dispersion model algorithms for simulating building downwash phenomena and roadside barrier effects can be developed and evaluated. The scope of this work assignment includes the design of wind tunnel experiments, the construction and installation of the scale models into the tunnel, the collection of velocity and concentration data and the analysis and documentation of the experiments and the results. The experimental measurement scheme shall be designed to provide a description of

downwash phenomena in the vicinity of modeled generic buildings as well as in the vicinity of roadside barriers.

TECHNICAL APROACH/OBJECTIVES

Task 1: With the goal of providing physical modeling data for dispersion model algorithm evaluation, the WACOR will specify the geometry of a model roadside barrier to be used in conjunction with a line source. These barriers may include solid and porous barrier of several different heights and will be located at various distances from the roadway.

The contractor shall design a measurement scheme and collect concentration and velocity data to describe roadside barrier flow and dispersion. Ground-level, longitudinal, lateral, and vertical profiles of concentrations shall be measured downwind of the modeled road.

In all model scenarios, the contractor shall perform measurements using Hydrocarbon Analyzers and Laser Doppler Anemometry. This work shall include tracer concentration and velocity measurements in and around the modeled roadway barriers. Model configurations shall make use of a boundary layer developed to simulate flow over suburban and light industrial areas with a roughness length of 0.27m (at a scale of 1:150). The contractor shall process and document the data and store it in spreadsheet format. The contractor shall review for quality, graph, and analyze the data and document the results. The contractor shall additionally document the experimental design and setup, the measurement protocol, and the resulting data file structure.

Task 2: With the goal of providing physical modeling data for dispersion model algorithm development, the WACOR will specify model geometry for generic building combinations and locations of neutrally buoyant tracer releases.

The contractor shall design a measurement scheme and collect concentration and velocity data to describe building downwash phenomena for single and multiple buildings with and without tiers. Ground-level, longitudinal, lateral, and vertical profiles of concentrations shall be measured downwind of the stack.

In all model scenarios, the contractor shall perform measurements using Hydrocarbon Analyzers and Laser Doppler Anemometry. This work shall include tracer concentration and velocity measurements in and around the stack/building combinations comprising the models. Model configurations shall make use of a boundary layer developed to simulate flow over suburban and light industrial areas with a roughness length of 0.27m (at a scale of 1:150). The contractor shall process and document the data and store it in spreadsheet format. The contractor shall review for quality, graph, and analyze the data and document the results. The contractor shall additionally document the experimental design and setup, the measurement protocol, and the resulting data file structure.

Task 3: In the process of performing the wind tunnel experimental program, the contractor shall diagnose operational problems with the meteorological wind tunnel and its velocity, turbulence, pressure, and tracer concentration measurement systems as well as the support equipment in the machine shop and recommend repairs as required.

QUALITY ASSURANCE

A Quality Assurance Project Plan (QAPP) shall be prepared by the contractor and submitted to the WACOR within 30 days of receipt of this work assignment. Calibrations of scientific instruments shall be performed under existing Standard Operating Procedures. Standard "good laboratory practices" for maintaining notebooks shall be employed.

DELIVERABLES

Unless otherwise specified in the tasks, all documents required under this Work Assignment shall be delivered to the WACOR and Contracting Officer's Representative (COR), both in hard copy and electronic format (Word).

Work Plan. A work plan containing a cost estimate shall be provided to the Contracting Officer (CO), COR and WACOR within 20 days of the Contracting Officer's signature.

The contractor shall supply reports documenting the work performed under the tasks in this work assignment, including the experimental design and setup, the measurement protocol, the resulting data file structure, the analysis results, and the data on files.

SCHEDULE of DELIVERABLES

Target Delivery Date of Final Report: 3/31/2017

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-119

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2016
Base Option Period Number 1

Title of Work Assignment/SF Site Name:

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:
The purpose of this amendment is to revise the PWS to add task.

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name David Heist	Branch/Mail Code:
	Phone Number: 919-541-1199
(Signature) (Date)	FAX Number:
Project Officer Name Robin Baily	Branch/Mail Code:
	Phone Number: 919-541-7906
(Signature) (Date)	FAX Number:
Other Agency Official Name	Branch/Mail Code:
	Phone Number:
(Signature) (Date)	FAX Number:
Contracting Official Name Mark Cranley	Branch/Mail Code:
	Phone Number: 513-487-2351
(Signature) (Date)	FAX Number: 513-487-2109

Performance Work Statement

WA Title: Fluid Modeling Facility Wind Tunnel Studies

WA #: 1-119 WACOR: David Heist

Contract #: EP-C-15-008 Alternate WACOR: William Benjey

Amendment 1: See new task #4 in bold below and an additional sentence in Scope in bold.

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

The purpose of this work assignment is to support the Fluid Modeling Facility's experimental research of flow and dispersion within the laboratory wind tunnel. Projects include the modeling of building downwash and flow and dispersion around various roadside barrier configurations. The goals are to develop a characterization of dispersion of steady state emissions of pollutants for various source configurations and an examination of the effects of the structures on pollutant dispersion.

BACKGROUND

Air emissions in urban areas and near buildings contribute significantly to overall exposure from air pollutants in many areas of the country. Pollutant monitoring alone cannot provide the temporal and spatial detail generally needed for regulatory work, exposure assessments and health studies. Therefore, air quality models are critical for providing reliable estimates of exposure and risk. The development and evaluation of such models require relevant laboratory and/or field measurements of flow and dispersion in the vicinity of buildings. The EPA's Fluid Modeling Facility has a long history of wind tunnel studies of flow around individual structures and arrays of model buildings and structures and is well suited for developing databases of flow and dispersion for use in model building and testing. The databases generated in this work assignment will be critical to the enhancement of building downwash algorithms noise barrier algorithms.

SCOPE

This task is intended to provide experimental data bases from which dispersion model algorithms for simulating building downwash phenomena and roadside barrier effects can be developed and evaluated. The scope of this work assignment includes the design of wind tunnel experiments, the construction and installation of the scale models into the tunnel, the collection of velocity and concentration data

and the analysis and documentation of the experiments and the results. **In addition, the contractor shall develop modeling constructs to simulate dispersion in these near-source situations.** The experimental measurement scheme shall be designed to provide a description of downwash phenomena in the vicinity of modeled generic buildings as well as in the vicinity of roadside barriers.

TECHNICAL APROACH/OBJECTIVES

Task 1: With the goal of providing physical modeling data for dispersion model algorithm evaluation, the WACOR will specify the geometry of a model roadside barrier to be used in conjunction with a line source. These barriers may include solid and porous barrier of several different heights and will be located at various distances from the roadway.

The contractor shall design a measurement scheme and collect concentration and velocity data to describe roadside barrier flow and dispersion. Ground-level, longitudinal, lateral, and vertical profiles of concentrations shall be measured downwind of the modeled road.

In all model scenarios, the contractor shall perform measurements using Hydrocarbon Analyzers and Laser Doppler Anemometry. This work shall include tracer concentration and velocity measurements in and around the modeled roadway barriers. Model configurations shall make use of a boundary layer developed to simulate flow over suburban and light industrial areas with a roughness length of 0.27m (at a scale of 1:150). The contractor shall process and document the data and store it in spreadsheet format. The contractor shall review for quality, graph, and analyze the data and document the results. The contractor shall additionally document the experimental design and setup, the measurement protocol, and the resulting data file structure.

Task 2: With the goal of providing physical modeling data for dispersion model algorithm development, the WACOR will specify model geometry for generic building combinations and locations of neutrally buoyant tracer releases.

The contractor shall design a measurement scheme and collect concentration and velocity data to describe building downwash phenomena for single and multiple buildings with and without tiers. Ground-level, longitudinal, lateral, and vertical profiles of concentrations shall be measured downwind of the stack.

In all model scenarios, the contractor shall perform measurements using Hydrocarbon Analyzers and Laser Doppler Anemometry. This work shall include tracer concentration and velocity measurements in and around the stack/building combinations comprising the models. Model configurations shall make use of a boundary layer developed to simulate flow over suburban and light industrial areas with a roughness length of 0.27m (at a scale of 1:150). The contractor shall process and document the data and store it in spreadsheet format. The contractor shall review for quality, graph, and analyze the data and document the results. The

contractor shall additionally document the experimental design and setup, the measurement protocol, and the resulting data file structure.

Task 3: In the process of performing the wind tunnel experimental program, the contractor shall diagnose operational problems with the meteorological wind tunnel and its velocity, turbulence, pressure, and tracer concentration measurement systems as well as the support equipment in the machine shop and recommend repairs as required.

Task 4: The contractor shall analyze wind tunnel measurements related to dispersion through roadside barriers and building influenced flows as provided by the WACOR. The contractor shall propose new algorithms or modifications to existing algorithms to account for the phenomena revealed in the wind tunnel measurements and any related results in the literature from field measurements. The contractor shall also perform testing and evaluation of the R-LINE model for a range of scenarios including the barrier algorithms and the depressed roadway algorithm in preparation for the release of version 2 of the model.

QUALITY ASSURANCE

A Quality Assurance Project Plan (QAPP) shall be prepared by the contractor and submitted to the WACOR within 30 days of receipt of this work assignment. Calibrations of scientific instruments shall be performed under existing Standard Operating Procedures. Standard "good laboratory practices" for maintaining notebooks shall be employed.

DELIVERABLES

Unless otherwise specified in the tasks, all documents required under this Work Assignment shall be delivered to the WACOR and Contracting Officer's Representative (COR), both in hard copy and electronic format (Word).

Work Plan. A work plan containing a cost estimate shall be provided to the Contracting Officer (CO), COR and WACOR within 20 days of the Contracting Officer's signature.

The contractor shall supply reports documenting the work performed under the tasks in this work assignment, including **new proposed modeling constructs,** the experimental design and setup, the measurement protocol, the resulting data file structure, the analysis results, and the data on files.

SCHEDULE of DELIVERABLES

Target Delivery Date of Final Report: 3/31/2017

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-119

☐ Other ☒ Amendment Number: 000002

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2016

Base Option Period Number 1

Title of Work Assignment/SF Site Name:

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:
The purpose of this amendment is to revise the PWS, changes are in bold.

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name David Heist
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-1199
FAX Number:

Project Officer Name Robin S. Harris
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0955
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Work Statement

WA Title: Fluid Modeling Facility Wind Tunnel Studies

WA #: 1-119 WACOR: David Heist

Contract #: EP-C-15-008 Alternate WACOR: William Benjey

Amendment 2: See additional work in task #3 in bold below.

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

The purpose of this work assignment is to support the Fluid Modeling Facility's experimental research of flow and dispersion within the laboratory wind tunnel. Projects include the modeling of building downwash and flow and dispersion around various roadside barrier configurations. The goals are to develop a characterization of dispersion of steady state emissions of pollutants for various source configurations and an examination of the effects of the structures on pollutant dispersion.

BACKGROUND

Air emissions in urban areas and near buildings contribute significantly to overall exposure from air pollutants in many areas of the country. Pollutant monitoring alone cannot provide the temporal and spatial detail generally needed for regulatory work, exposure assessments and health studies. Therefore, air quality models are critical for providing reliable estimates of exposure and risk. The development and evaluation of such models require relevant laboratory and/or field measurements of flow and dispersion in the vicinity of buildings. The EPA's Fluid Modeling Facility has a long history of wind tunnel studies of flow around individual structures and arrays of model buildings and structures and is well suited for developing databases of flow and dispersion for use in model building and testing. The databases generated in this work assignment will be critical to the enhancement of building downwash algorithms noise barrier algorithms.

SCOPE

This task is intended to provide experimental data bases from which dispersion model algorithms for simulating building downwash phenomena and roadside barrier effects can be developed and evaluated. The scope of this work assignment includes the design of wind tunnel experiments, the construction and installation of the scale models into the tunnel, the collection of velocity and concentration data and the analysis and documentation of the experiments and the results. In addition,

the contractor shall develop modeling constructs to simulate dispersion in these near-source situations. The experimental measurement scheme shall be designed to provide a description of downwash phenomena in the vicinity of modeled generic buildings as well as in the vicinity of roadside barriers.

TECHNICAL APROACH/OBJECTIVES

Task 1: With the goal of providing physical modeling data for dispersion model algorithm evaluation, the WACOR will specify the geometry of a model roadside barrier to be used in conjunction with a line source. These barriers may include solid and porous barrier of several different heights and will be located at various distances from the roadway.

The contractor shall design a measurement scheme and collect concentration and velocity data to describe roadside barrier flow and dispersion. Ground-level, longitudinal, lateral, and vertical profiles of concentrations shall be measured downwind of the modeled road.

In all model scenarios, the contractor shall perform measurements using Hydrocarbon Analyzers and Laser Doppler Anemometry. This work shall include tracer concentration and velocity measurements in and around the modeled roadway barriers. Model configurations shall make use of a boundary layer developed to simulate flow over suburban and light industrial areas with a roughness length of 0.27m (at a scale of 1:150). The contractor shall process and document the data and store it in spreadsheet format. The contractor shall review for quality, graph, and analyze the data and document the results. The contractor shall additionally document the experimental design and setup, the measurement protocol, and the resulting data file structure.

Task 2: With the goal of providing physical modeling data for dispersion model algorithm development, the WACOR will specify model geometry for generic building combinations and locations of neutrally buoyant tracer releases.

The contractor shall design a measurement scheme and collect concentration and velocity data to describe building downwash phenomena for single and multiple buildings with and without tiers. Ground-level, longitudinal, lateral, and vertical profiles of concentrations shall be measured downwind of the stack.

In all model scenarios, the contractor shall perform measurements using Hydrocarbon Analyzers and Laser Doppler Anemometry. This work shall include tracer concentration and velocity measurements in and around the stack/building combinations comprising the models. Model configurations shall make use of a boundary layer developed to simulate flow over suburban and light industrial areas with a roughness length of 0.27m (at a scale of 1:150). The contractor shall process and document the data and store it in spreadsheet format. The contractor shall review for quality, graph, and analyze the data and document the results. The contractor shall additionally document the experimental design and setup, the measurement protocol, and the resulting data file structure.

Task 3: In the process of performing the wind tunnel experimental program, the contractor shall diagnose operational problems with the meteorological wind tunnel and its velocity, turbulence, pressure, and tracer concentration measurement systems as well as the support equipment in the machine shop and recommend repairs as required. **The contractor shall procure and install a sonic anemometer in the Meteorological Wind Tunnel to measure and record the reference wind speed. The reference wind speed shall be measured approximately 7.5 m from the entrance of the tunnel at a height of 1 to 1.5 m above the floor. The sonic anemometer shall be mounted from above the wind tunnel through the ceiling of the test section. The contractor shall modify the LabView data acquisition software to record the reference wind speed during experiments.**

Task 4: The contractor shall analyze wind tunnel measurements related to dispersion through roadside barriers and building influenced flows as provided by the WACOR. The contractor shall propose new algorithms or modifications to existing algorithms to account for the phenomena revealed in the wind tunnel measurements and any related results in the literature from field measurements. The contractor shall also perform testing and evaluation of the R-LINE model for a range of scenarios including the barrier algorithms and the depressed roadway algorithm in preparation for the release of version 2 of the model.

QUALITY ASSURANCE

A Quality Assurance Project Plan (QAPP) shall be prepared by the contractor and submitted to the WACOR within 30 days of receipt of this work assignment. Calibrations of scientific instruments shall be performed under existing Standard Operating Procedures. Standard "good laboratory practices" for maintaining notebooks shall be employed.

DELIVERABLES

Unless otherwise specified in the tasks, all documents required under this Work Assignment shall be delivered to the WACOR and Contracting Officer's Representative (COR), both in hard copy and electronic format (Word).

Work Plan. A work plan containing a cost estimate shall be provided to the Contracting Officer (CO), COR and WACOR within 20 days of the Contracting Officer's signature.

The contractor shall supply reports documenting the work performed under the tasks in this work assignment, including new proposed modeling constructs, the experimental design and setup, the measurement protocol, the resulting data file structure, the analysis results, and the data on files.

SCHEDULE of DELIVERABLES

Target Delivery Date of Final Report: 3/31/2017

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-120

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base Option Period Number 1	Statistical Models...

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 5.2

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 06/10/2016 To 10/31/2016

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Contract Period	Cost/Fee	LOE
	04/01/2015 To 03/31/2017		0
This Action:			125
Total:			125

Work Plan / Cost Estimate Approvals

Contractor WP Dated:	Cost/Fee	LOE:
Cumulative Approved:	Cost/Fee	LOE:

Work Assignment Manager Name Karen Bradham	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-9414 FAX Number:
Project Officer Name Robin Baily	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Mark Cranley	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

Performance Statement of Work (PWS)

WA Title: Statistical models soil bioavailability
WA #: WA 1-120

WA COR: Karen Bradham

Period of Performance: The period of performance detailed in this Performance Work Statement (PWS) shall be from the time of award through acceptance of the final deliverable scheduled for delivery on September 30, 2016.

Summary of Objectives: The contractor shall develop statistical models to test hypotheses and make predictions related to a) soil physicochemical properties that influence arsenic and lead bioavailability in soils, and b) relationships between soil metal bioavailability and related, field collected lead exposure metrics.

Scope/ Technical Approach: Statistical modeling will establish quantitative, probabilistic relationships between soil arsenic and lead bioavailability and various predictor variables (e.g., soil physicochemical characteristics). These statistical modeling efforts will build upon previously published work by US EPA's Office of Research and Development performed in collaboration with NC State's Department of Civil, Construction and Environmental Engineering, Raleigh, NC (http://pubs.acs.org/doi/abs/10.1021/acs.est.5b00905).

Due to the hierarchical organization of the data (i.e., by source type, field site, and laboratory trial), these analyses will be conducted using a Bayesian hierarchical (a.k.a. multilevel) framework capable of assessing and representing variability among different levels of organization. In addition, because the response variable (i.e., soil metal bioavailability) often demonstrates heteroscedasticity, variance parameters may be modeled within the overarching predictive model. Response variables (and model residuals) shall be tested for spatial and temporal autocorrelation, and this correlation shall be accounted for within the predictive models, as required. To prevent over-parameterization, predictor variable shall be selected using statistical information criteria (e.g., Bayesian Information Criterion, Deviance Information Criterion).

To evaluate relationships between soil metal bioavailability and related field-collected lead exposure metrics, statistical analyses shall include linear regression, outlier detection, and spatial autocorrelation analyses.

Statistical analyses shall be performed using R software. Data used for statistical model development, including soil metal bioavailability data, soil physiochemical data, and related exposure metric data, will be provided by the WACOR.

In addition to statistical model development and related statistical evaluation, work performed under this SOW will include assistance in preparation of at least two manuscripts under the direction of the WACOR.

Quality Assurance: The Contractor shall use the existing EPA-approved Category B QAPP for the Toxic Element Bioavailability Laboratory (D-EMMD-PHCB-003-QAPP-02), which under Section 4. Experimental Design describes the development of statistical methods such as hierarchical regression model

development and correlation/regression analyses to evaluate mechanism influencing metal bioavailability in soil. The QAPP may be amended by the WA COR to include additional project personnel.

Project Deliverables: Project deliverables shall include:

Deliverable	*Schedule*
Monthly progress reports to include current results summaries	Ongoing during performance period
R scripts	September 30, 2016
R input data files	September 30, 2016
Assistance in report and manuscript development, including text and figure development, for manuscript relating soil metal bioavailability with other field-collected exposure metrics.	August 31, 2016
Assistance in report and manuscript development, including text and figure development for manuscript relating soil metal bioavailability with soil physicochemical properties	September 30, 2016
Written responses to peer-review comments related to statistical work completed under this statement of work (as needed and only if manuscript peer review comments responses received within statement of work period)	September 30, 2016

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-120

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2017 To 03/31/2018 Base Option Period Number 1	

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 06/10/2016 To 03/31/2017

Comments:
The purpose of this amendment is to revise the PWS. Please submit a revised technical memo and cost estimate within 7 days.

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2017 To 03/31/2018 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Karen Bradham (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-9414 FAX Number:	
Project Officer Name: Robin S. Harris (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-0955 FAX Number:	
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:	
Contracting Official Name: Mark Cranley (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109	

Performance Statement of Work (PWS)

WA Title: Statistical models soil bioavailability
WA #: WA 1-120

WA COR: Karen Bradham

Period of Performance: The period of performance detailed in this Performance Work Statement (PWS) shall be from the time of award through acceptance of the final deliverable scheduled for delivery on March 31, 2017.

Summary of Objectives: The contractor shall develop statistical models to test hypotheses and make predictions related to a) soil physicochemical properties that influence arsenic and lead bioavailability in soils, and b) relationships between soil metal bioavailability and related, field collected lead exposure metrics.

Scope/ Technical Approach: Statistical modeling will establish quantitative, probabilistic relationships between soil arsenic and lead bioavailability and various predictor variables (e.g., soil physicochemical characteristics). These statistical modeling efforts will build upon previously published work by US EPA's Office of Research and Development performed in collaboration with NC State's Department of Civil, Construction and Environmental Engineering, Raleigh, NC (http://pubs.acs.org/doi/abs/10.1021/acs.est.5b00905).

Due to the hierarchical organization of the data (i.e., by source type, field site, and laboratory trial), these analyses will be conducted using a Bayesian hierarchical (a.k.a. multilevel) framework capable of assessing and representing variability among different levels of organization. In addition, because the response variable (i.e., soil metal bioavailability) often demonstrates heteroscedasticity, variance parameters may be modeled within the overarching predictive model. Also, response variables (and model residuals) will be tested for spatial and temporal autocorrelation, and this correlation will be accounted for within the predictive models, as required. To prevent over-parameterization, predictor variable should be selected using statistical information criteria (e.g., Bayesian Information Criterion, Deviance Information Criterion).

Models will be developed to predict As and Pb bioaccessibility on both a mass fraction basis (mg metal/kg soil) and a % bioaccessibility basis, which may require different modeling approaches. Modeling on a mass fraction basis will provide an estimate of the total amount (mg/kg) of bioaccessible As or Pb using a hieararchical linear regression. To explore potential mechanistic relationships between bioaccessibility and soil metals, models that predict the proportion of bioaccessible As and Pb (i.e. the ratio of bioaccessible As or Pb to total As or Pb) will be developed. Because the expected distribution of proportions is limited from 0 to 1, it is necessary to use an appropriate link function to transform the linear regression to a censured one. This work will explore different link functions, develop new models, and calculate error estimates and uncertainty for these models.

To evaluate relationships between soil metal bioavailability and related field-collected lead exposure metrics, statistical analyses will include linear regression, outlier detection, and spatial autocorrelation analyses.

Statistical analyses will be performed using R software. Data used for statistical model development, including soil metal bioavailability data, soil physiochemical data, and related exposure metric data, will be provided by the WACOR.

In addition to statistical model development and related statistical evaluation, work performed under this SOW will include assistance in preparation of at least two manuscripts under the direction of the WACOR.

Quality Assurance: The Contractor shall use the existing EPA-approved Category B QAPP for the Toxic Element Bioavailability Laboratory (D-EMMD-PHCB-003-QAPP-02), which under Section 4. Experimental Design describes the development of statistical methods such as hierarchical regression model development and correlation/regression analyses to evaluate mechanism influencing metal bioavailability in soil. The QAPP may be amended by the WA COR to include additional project personnel.

Project Deliverables: Project deliverables will include:

Deliverable	*Schedule*
Monthly progress reports to include current results summaries	Ongoing during performance period
R scripts	September 30, 2016
R input data files	September 30, 2016
Assistance in report and manuscript development, including text and figure development, for manuscript relating soil metal bioavailability with other field-collected exposure metrics.	**March 31, 2017**
Assistance in report and manuscript development, including text and figure development for manuscript relating soil metal bioavailability with soil physicochemical properties	**March 31, 2017**
Written responses to peer-review comments related to statistical work completed under this statement of work (as needed and only if manuscript peer review comments responses received within statement of work period)	**March 31, 2017**

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-121

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base Option Period Number 1

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Kevin Sudderth
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-3670
FAX Number:

Project Officer Name Robin S. Harris
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0955
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

PERFORMANCE WORK STATEMENT
CONTRACT NO. EP-C-15-008
WA 1-121

TITLE: Scientific and Technical Editing and Writing for the Exposure Methods and Measurement Division (EMMD)

Specify Section & Paragraph SOW: A. Assessment Issues and Documents
1. Human Health Assessment Documents; E. Risk Assessment Support; F. Information Management

PERIOD OF PERFORMANCE: *Time of award through 03/31/2017*

I. PURPOSE

The purpose of this Work Assignment (WA) is to provide the U.S. Environmental Protection Agency's (EPA) Exposure Methods and Measurement Division (EMMD), National Exposure Research Laboratory (NERL), Office of Research and Development (ORD), scientific and technical editing and writing support for the publication of manuscripts authored by EMMD researchers in peer-reviewed journals.

II. BACKGROUND

Within EPA's Office of Research and Development (ORD) is one of the Agency's premier research organizations – the National Exposure Research Laboratory (NERL). The NERL is strategically positioned to provide exposure science leadership not only to EPA and across the Federal government, but to the broader scientific community on emerging exposure science challenges. NERL's multidisciplinary expertise enables the laboratory to bring innovative research and technology to address critical exposure questions and to develop approaches for reducing exposures which are necessary to protect human health and the environment. Headquartered in Research Triangle Park, N.C., NERL has more than 300 scientists, engineers and staff across three divisions in four locations: Research Triangle Park, NC; Cincinnati, Ohio; Athens, Georgia; and Las Vegas, Nevada.
Exposure science is a multidisciplinary systems science that describes and connects processes responsible for fate and transport of stressors as they move from sources to impact receptors in organisms (USEPA, 2014). A description of environmental systems and populations in those systems requires linking many processes and must rely upon input from many disciplines. Within the NERL are three unique yet highly interlinked Divisions that function cohesively to address the significant issue of exposure and risk to human health and the environment. These Divisions are the:

- Exposure Methods and Measurement Division
- Computational Exposure Division (CED)
- Systems Exposure Division (SED)

EMMD generates and provides measurement data for evaluating stressors in the environment. From these EMMD measurements, CED uses the data to develop decision-support tools and models to be applied to media-specific or receptor-specific problem areas. SED integrates exposure data, tools, models, and methods to assess cumulative exposures to inform systems-based approaches capable of organizing current knowledge, simulating potential futures, and synthesizing results to inform decisions. In advancing exposure science, EMMD is committed to publishing all of its research findings in peer-reviewed journal articles.

III. STATEMENT OF WORK

Task 1: Establish Communication

Within 3 days of start date of this WA, the Contractor shall schedule a conference call (not to exceed 1 hour) with the WAM and appropriate contractor staff to clarify outstanding questions and confirm the schedule and specific tasks.

Task 2: Work Plan, Staffing Plan, and Quality Assurance Project Plan (QAPP) (completed in Option 1)

The Contractor shall prepare a Technical Work Plan describing how the work outlined in this Performance Work Statement will be performed, including deliverables, a schedule, budget, and level of effort. The Contractor shall also prepare a Staffing Plan, which shall be submitted as part of the Work Plan, which shows assigned personnel by task and the qualifications of the proposed personnel. The contractor shall be responsible for editing the technical content of 7 manuscripts to be published as articles in peer-reviewed journal articles. In all assignments under this WA, the contractor shall conform to guidance under Section VII below. Assignments will vary in the level of user readability, ranging from highly technical translated scientific and technical information to text more appropriate for a broader range of stakeholders and education.

The contractor shall maintain communication with the COR through weekly phone calls or email updates and attend meetings of the SSWR team as necessary. Due to the nature of the work being requested, technical clarification from the COR will be required. All technical clarification shall be documented by both the COR and contractor. The contractor shall ensure that all tasks are progressing on schedule and are delivered by the deadlines agreed upon by the COR, technical contact and the contractor.

No data will be generated as a result of this WA so a QAPP is not required

Task 3: Prepare SSWR materials.

The contractor shall be responsible for integration, compilation, drafting and/or editing text to be used by EPA for various materials including the program's research plans, project summaries, requests for proposal announcements, briefings, communications and others. Tasks will vary in the level of user readability, ranging from highly technical translated scientific and technical information to text more appropriate for a broader range of stakeholders and education. The contractor may also suggest additional contributions to the writing process as required, including literature review and synthesis.

IV. ANTICIPATED DELIVERABLES

All products by the Contractor must be of high quality, written in a clear concise style, with a logical organization and presentation. Deliverables shall be provided to EPA in electronic formats compatible with EPA-supported software (e.g., Excel spreadsheets, Word documents, BMDS accessory files [*.(d), *.out, *opt, *.ssn]).

V. DELIVERABLES AND SCHEDULE

Task 1. Initial Conference Call	3 days after award of Work Assignment
Task 2. Staffing Plan, and QAPP	Per contract requirements
Task 3. Prepare SSWR materials	In accordance with Technical Work Plan prepared under Task 2

Note: All days are calendar days.

VI. MANAGEMENT CONTROLS

1. All deliverables shall be reviewed for conformance to the requirements of this work assignment before being approved as final.

2. The contractor shall comply with other applicable requirements for final work assignment reports stipulated in contract.

VII. NOTICE REGARDING GUIDANCE PROVIDED UNDER THIS PROJECT

Guidance is strictly limited to technical and analytical support. The contractor shall not engage in activities of an inherent governmental nature such as the following:

(1) Formulation of Agency policy
(2) Selection of Agency priorities
(3) Development of Agency regulations

Should the contractor receive any instruction from an EPA staff person that the contractor ascertains to fall into any of these categories or goes beyond the scope of the contract or work assignment, the contractor shall immediately contact the PO, WAM or CO

VIII. SPECIAL CONDITIONS AND ASSUMPTIONS

The contractor shall hold a conference call with the EPA WAM at the initiation of the work assignment, and shall provide a weekly update to the WAM by telephone for the duration of the work assignment, in addition to the standard reporting requirements of the contract.

IX. EPA CONTACT INFORMATION

Copies of all correspondence pertaining to the performance of this work assignment shall be sent to the PO.

Work Assignment Manager (WAM):

Kevin Sudderth
Telephone: 919-541-3670
e-mail: sudderth.kevin@epa.gov

Mailing Address:
U.S. Environmental Protection Agency
MD E205-01
Research Triangle Park, NC 27711

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-122

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base Option Period Number 1

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Jonathan Krug
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-2379
FAX Number:

Project Officer Name Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Fine and Ultrafine Aerosol Measurement Validation

WA #: 1-122 WACOR: Jonathan Krug

Contract #: EP-C-15-008 Alternate WACOR: Robert Vanderpool

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

By agreements with the Office of Air Quality Planning and Standards (OAQPS), the National Exposure Research Laboratory (NERL) of the Office of Research and Development (ORD) provides research and development of new air monitoring methods and associated quality assurance procedures in connection with new or existing national ambient air quality standards (NAAQS). In order to respond to the needs of OAQPS in a timely manner NERL must maintain functional knowledge of new technologies which may be of interest in the future. Research and technical support is needed which will include (1) review and evaluation of ultrafine aerosol sampler evaluation techniques, (2) development of an ultrafine aerosol sampler evaluation test bench, and (3) technical evaluation of ultrafine aerosol sampling instruments to determine their suitability as potential Federal Equivalency Methods for measurement of ultrafine particles under the NAAQS. This evaluation will involve technical support related to the operation, performance, and quality assurance of ultrafine aerosol measurement devices.

BACKGROUND

Ultrafine particles (UFPs) are particulate matter of nanoscale size (less than 100 nanometers in diameter). Ultrafine particles are both emitted directly and formed in the atmosphere and are the main constituent of airborne particulate matter on a count basis. The EPA does not currently regulate UFPs but may wish to in the future. Prior to developing regulation of UFPs, there is need to improve understanding of potential health effects related to UFP exposure. Due to their size, UFPs are considered to be respirable particles and are typically deposited in the lungs. Evidence is limited but suggestive for cardiovascular and respiratory effects associated with short-term exposures. There are significant uncertainties related to characterizing UFP exposures including limited routine monitoring, and strong spatial and temporal variability. These limitations must be addressed to improve our understanding of potential health effects related to UFP exposures and the role the ultrafine fraction plays in air pollution.

SCOPE

The contractor shall carry out activities related to the setup and evaluation of an ultrafine aerosol test bench for the evaluation of ultrafine aerosol measurement methods and instruments. This may include the setup, testing, and evaluation of ultrafine aerosol generation devices, assembly of a mixing system, sample ballast, sampling ports, in addition to ultrafine aerosol sampling devices.

TECHNICAL APROACH/OBJECTIVES

Task 1. Setup of Ultrafine Aerosol Test Bench

The evaluation on a common basis of the measurement capabilities, accuracy, precision, and reliability of ultrafine aerosol measurement devices requires a common and controlled source and testing environment. To address this need the contractor shall assemble, test, and troubleshoot an ultrafine aerosol test bench. The test bench shall generally consist of an aerosol source, a dilution stream, and a sampling chamber for connection of various ultrafine aerosol sampling devices. Each sampling port should have equal concentration and size distribution profiles as verified by SMPS. Aerosol sources and mixing system will be GFE.

Task 2. Evaluation of Environmental Particle Counter (EPC)

In support of the NERL's research and development of new air monitoring methods and associated quality assurance procedures in connection with new or existing NAAQS the contractor shall conduct laboratory and/or field tests, as directed, related to the investigation of potential measurement anomalies, inaccuracies, or other technical deficiencies associated with the EPC. As directed by the EPA's WACOR the contractor shall employ the use of aerosol samplers during the evaluation of the EPC including but not limited to: TSI Model 3340 Laser Aerosol Spectrometer, and the TSI Model 3085 Differential Mobility Analyzer in conjunction with TSI Model 3080 Electrostatic Classifier. The contractor should develop a Standard Operating Procedure (SOP) document for the EPC in accordance with EMMD guidelines.

In order to perform the evaluation of the Environmental Particle Counter the contractor shall purchase for use on this SOW a TSI Model 3783 Environmental Particle Counter (EPC), and associated accessories required for laboratory and field evaluation of the EPC (TSI Model 3032 Vacuum Pump, TSI Model 3031200 Environmental Sampling System, and TSI Model 1183001 3783 Maintenance Kit). Procurement of additional equipment and/or laboratory supplies may be required to complete this SOW as directed by EPA's WACOR.

QUALITY ASSURANCE (QA)

Standard "good laboratory practices" for maintaining notebooks shall be employed.

The contractor shall follow the protocols, procedures and guidelines of the manufacturer's supplied use manuals as provided.

Calibration and operation of scientific instruments shall be performed under existing SOPs contained in the Quality Assurance Project Plan "Maintenance, Management, Operation, and Analysis of the Aerosol Test Facility".

DELIVERABLES

Work Plan. A work plan containing a cost estimate shall be provided to the Contracting Officer (CO), PO and WA COR.

Task 1. Setup of Ultrafine Aerosol Test Bench.

The functional characteristics of an ultrafine aerosol test bench capable of generation of various size and concentration ultrafine aerosol shall be provided in the form of spreadsheets and Word documents. Both hard copy and electronic formats of results shall be provided.

Task 2. Evaluation of Environmental Particle Counter.

The contractor shall provide data with results of the EPC evaluation in both hard copy and electronic formats. An SOP should be developed including laboratory and field operation of the EPC in accordance with EMMD guidelines.

SCHEDULE of DELIVERABLES

Work Plan: Within 20 days of receipt of the Work Assignment or as specified in the contract.

Task 1: As indicated in each Technical Directive issued.

Task 2: Target Delivery Date: 3/31/2017.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-123

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base Option Period Number 1	1-123 TCRR Lab Support

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2):

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Marsha Morgan (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-2598 FAX Number:	
Project Officer Name Robin Baily (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:	
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:	
Contracting Official Name Mark Cranley (Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109	

Performance Statement of Work

WA Title: Tire Crumb Rubber Research Field and Laboratory Support

WA Short Title: TCRS Support

WA #: 1-123

WACOR: Marsha Morgan

Contract #: EP-C-15-008

Alternate WACOR: Kent Thomas

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from award through March 31, 2017.

SUMMARY OF OBJECTIVES

To provide field sampling and laboratory support for research on synthetic turf fields with tire crumb rubber infill. The contractor shall provide support for sample collections to be performed for the tire crumb rubber characterization and the exposure characterization portions of the research study under the Research Protocol entitled 'Collections Related to Synthetic Turf Fields with Crumb Rubber Infill'. The contractor shall provide laboratory support for material and equipment preparation, sample handling and preparation, and shipping activities.

BACKGROUND

Concerns have been raised by the public about the safety of recycled tire crumb rubber used in synthetic turf fields and playgrounds in the United States (U.S.). Several previous studies have examined human exposure to tire crumb rubber infill in these settings. While, in general, these studies have not provided evidence for these health concerns, the existing studies do not comprehensively evaluate all aspects of exposure associated with these use scenarios. Additional research is needed to help fill important data gaps that will lead to improved exposure assessment and risk evaluation for children and adults using synthetic turf fields and playgrounds with tire crumb rubber. In response, the U.S. Environmental Protection Agency (EPA), the Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry (CDC/ATSDR), and the U.S. Consumer Product Safety Commission (CPSC) have launched a multi-agency federal action plan to study key environmental human health questions associated with tire crumb rubber on synthetic turf fields and playgrounds.

The "Federal Research Action Plan on Recycled Tire Crumb Used on Playing Fields and Playgrounds" (referred to subsequently as the Federal Research Action Plan [FRAP] https://www.epa.gov/chemical-research/federal-research-recycled-tire-crumbs-used-playing-fields) was recently finalized in February 2016. The U.S. EPA and CDC/ATSDR have jointly prepared a Research Protocol to implement portions of these research activities outlined under the FRAP. For this PSOW, major activities to be implemented via the research protocol include:

1) Perform a tire crumb rubber characterization study, and

2) Perform a human exposure characterization study.

The tire crumb rubber characterization study is a pilot-scale effort that will have five main components: First, the study will involve the collection of crumb rubber material from tire recycling plants and synthetic turf fields around the U.S., followed by laboratory analysis of the material for a wide range of metals, volatile organic compounds (VOCs), and semi-volatile organic compounds (SVOCs). Second, laboratory analyses will also include dynamic emission chamber measurements for VOCs and SVOCs in crumb rubber materials under different temperature conditions and bioaccessibility measurements for metals and SVOCs. The emissions and bioaccessibility experiments will provide important information about the types and amounts of chemical constituents in the tire crumb rubber material that are potentially available for human exposure through the inhalation, dermal, and indirect ingestion routes. Third, the study will involve suspect screening and non-targeted analysis methods for unknown VOCs and SVOCs in an attempt to identify other potential chemicals of interest. Fourth, the study will collect tire crumb rubber infill from synthetic turf fields to assess microbial populations. Lastly, this study will identify and collate extant toxicity reference data for selected chemicals of interests identified through the above laboratory analyses.

The exposure characterization study is a pilot-scale effort to: (a) collect information on human activity parameters for synthetic turf field users that affect potential exposures to tire crumb rubber constituents; and (b) implement a human exposure measurement study to further develop and deploy appropriate sample collection methods and to generate data for improved exposure characterization. This data collection will involve adults and children who use synthetic turf fields with tire crumb rubber infill. Information will be collected to provide data about relevant parameters for characterizing and modeling exposures associated with the use of synthetic turf fields. A set of personal and field environment samples will be collected around a sport or training activity performed by participants on a synthetic turf field. Personal (air VOC and dermal wipes for metals and SVOCs) and environmental samples (air VOCs, SVOCs, metals/particulate; field wipe samples for metals and SVOCs; drag sled sampling for SVOCs; and dust for metals and SVOCs). Samples will be analyzed for targeted metal, VOC, and SVOC analytes, and a subset of SVOC samples will undergo non-targeted analysis. A subset of

participants (adults and children) will have video data collection performed during a physical activity (i.e., playing soccer) on a synthetic turf field.

SCOPE

The contractor shall provide technical support to implement specific field sampling and laboratory activities in support of the research described in the Research Protocol. Specific study activities include:

1) Collection and shipment of tire crumb rubber samples from tire recycling plants.
2) Collection and shipment of tire crumb rubber samples from synthetic turf fields.
3) Processing, preparing, and shipping tire crumb rubber samples and sub-samples from tire recycling plants and synthetic turf fields for analysis and storage.
4) Collection, shipment, and processing of environmental and personal samples, and collection of videographic activity information, in the exposure characterization portion of the study.

The research design is constrained by a number of factors, most importantly the short timeline for field study completion, with sample collection, analysis, and reporting required by the end of 2016. The very short time frames for sample collection and sample processing are reflected in the Deliverables and Schedule.

The EPA will provide the contractor with the Research Protocol, Quality Assurance Project Plans (QAPPs; Category B), and Standard Operating Procedures (SOPs) relevant to the support activities described with the PWS. Due to the very aggressive timeline for this research some of these documents are still in process. EPA will be responsible for preparing draft and final versions of these documents. Contractor recommendations for essential revisions to the QAPP and SOP documents can be provided to, and will be considered by the WACOR. The types of documents and information about their status is provided here:

a) Research Protocol: a final draft version will be provided along with this PWS. The final version, with only minor wording changes, is anticipated to be completed by August 5.

b) QAPPs: Draft QAPPs are anticipated to be available by August 5, 2016. It is likely that the initial QAPPs will be conditionally approved for initial use in the tire crumb characterization portion of the study, with subsequent updating and approval for the exposure characterization portion of the study.

c) SOPs: Draft SOPs for the tire crumb rubber characterization part of the study include sample collection at recycling plants, sample collection at synthetic

turf fields, and preparing/processing tire crumb rubber samples. Draft versions of these three SOPs are anticipated to be available by August 5, 2016. Final approved versions of these SOPs are anticipated to be available by August 12, 2016. Draft SOPs for the exposure characterization sample collection are anticipated to be available in late August, with final approved versions available in mid-September, 2016.

At this time, the total number of synthetic turf fields requiring contractor support for sample collection is not exactly known because the U.S. Army will collect samples at some (≤20), as yet unspecified number of fields on their installations separately from this work assignment, and because the success of pending field recruitment is not known. Tasks 3 and 4 are included as optional tasks to support sample collection at additional synthetic turf fields past the initial 20 fields specified in Task 2. The contractor shall include costs for these Tasks in their cost estimates. The option to exercise these Tasks will be at the WACOR's discretion and will depend on funds availability and the need to meet overall research objectives.

The contractor shall schedule a meeting with the WACOR within 3 business days of receipt of the work assignment package from the Contract Officer.

TECHNICAL APPROACH/OBJECTIVES

Task 1: Tire Crumb Rubber Collection and Shipping from Tire Recycling Plants

EPA will identify up to nine recycling plants in the U.S. that produce tire crumb rubber for use on synthetic turf fields. EPA anticipates that the likely number of plants that the contractor shall sample will be between three and five, with a maximum of nine. The contractor shall collect tire crumb rubber samples at the identified recycling plants following the Research Protocol and SOPs using containers and sampling devices provided by EPA. The contractor shall ship the samples to the EPA facility in Research Triangle Park (RTP), NC.

For costing purposes, the contactor shall assume travel and shipping costs as follows:

- 3 recycling plants on the U.S. West Coast
- 3 recycling plants in the central U.S.
- 3 recycling plants on the U.S. East Coast.

The actual locations of the recycling plants may differ from this assumed geographical distribution.

The contractor shall abide by all the terms of the sampling agreement form (see Research Protocol appendix), including all privacy protections. The contractor shall work under collection schedules arranged by the EPA and will alert the WACOR to any scheduling conflicts or difficulties for resolution. It is anticipated that sample

collection will be scheduled at no more than 3 recycling plants in a week. It is anticipated that sampling can be performed by 2-person teams, and that each team can collect samples at up to two recycling plants per week. The EPA WACOR will discuss collection schedules and work capacity with the contractor.

Task 2: Tire Crumb Rubber Collection and Shipping from 20 Synthetic Turf Fields

EPA will identify up to 20 synthetic turf fields in the U.S. that use tire crumb rubber as an infill material. The contractor shall collect tire crumb rubber samples at the identified synthetic turf fields following the Research Protocol and SOPs using containers and sampling devices provided by EPA. The contractor shall ship the samples designated for chemical analysis to the EPA facility in RTP, NC and the samples designated for microbiological analysis to the EPA facility in Cincinnati, OH.

For costing purposes, the contactor shall assume travel and shipping costs as follows:

- 5 fields in the Northeast U.S. census region
- 5 fields in the South U.S. census region
- 5 fields in the Midwest U.S. census region
- 5 fields in the West U.S. census region

The actual locations of the synthetic turf fields may differ from this assumed geographical distribution. Note that the total number of fields included for sample collection in this PWS is less than the 40 described in the Research Protocol because some fields will be sampled by the U.S. Army and/or EPA staff.

The contractor shall abide by all the terms of the sampling agreement form (see Research Protocol appendix), including all privacy protections. The contractor shall work under collection schedules arranged by the EPA and will alert the WACOR to any scheduling conflicts or difficulties for resolution. It is anticipated that sample collection will be scheduled at up to 4 synthetic turf fields in a week. It is anticipated that sampling can be performed by 2-person teams, and that each team can collect samples at up to two synthetic fields per week. The EPA WACOR will discuss collection schedules and work capacity with the contractor.

Task 3: – Optional: Tire Crumb Rubber Collection and Shipping from 5 Additional Synthetic Turf Fields

This is an optional task that may be exercised by EPA to meet research goals for the number of synthetic turf fields included in the research study that would bring the total number of fields sampled by the contractor up to 25.

EPA will identify up to five additional synthetic turf fields in the U.S. that use tire crumb rubber as an infill material. The contractor shall collect tire crumb rubber

samples at the identified synthetic turf fields following the Research Protocol and SOPs. The contractor shall ship the samples designated for chemical analysis to the EPA facility in RTP, NC and the samples designated for microbiological analysis to the EPA facility in Cincinnati, OH.

For costing purposes, the contactor shall assume travel and shipping costs as follows:

- 1 field in the Northeast U.S. census region
- 1 field in the South U.S. census region
- 2 fields in the Midwest U.S. census region
- 1 field in the West U.S. census region

The actual locations of the synthetic turf fields may differ from this assumed geographical distribution.

The contractor shall abide by all the terms of the sampling agreement form (see Research Protocol appendix), including all privacy protections. The contractor shall work under collection schedules arranged by the EPA and will alert the WACOR to any scheduling conflicts or difficulties for resolution. It is anticipated that sample collection will be scheduled at up to 4 synthetic turf fields in a week. It is anticipated that sampling can be performed by 2-person teams, and that each team can collect samples at up to two synthetic fields per week. The EPA WACOR will discuss collection schedules and work capacity with the contractor.

Task 4: – Optional: Tire Crumb Rubber Collection from 5 Additional Synthetic Turf Fields

This is an optional task that may be exercised by EPA to meet research goals for the number of synthetic turf fields included in the research study that would bring the total number of fields sampled by the contractor up to 30.

EPA will identify up to five additional synthetic turf fields in the U.S. that use tire crumb rubber as an infill material. The contractor shall collect tire crumb rubber samples at the identified synthetic turf fields following the Research Protocol and SOPs. The contractor shall ship the samples designated for chemical analysis to the EPA facility in RTP, NC and the samples designated for microbiological analysis to the EPA facility in Cincinnati, OH.

For costing purposes, the contactor shall assume travel and shipping costs as follows:

- 1 field in the Northeast U.S. census region
- 1 field in the South U.S. census region
- 2 fields in the Midwest U.S. census region
- 1 field in the West U.S. census region

The actual locations of the synthetic turf fields may differ from this assumed geographical distribution.

The contractor shall abide by all the terms of the sampling agreement form (see Research Protocol appendix), including all privacy protections. The contractor shall work under collection schedules arranged by the EPA and will alert the WACOR to any scheduling conflicts or difficulties for resolution. It is anticipated that sample collection will be scheduled at up to 4 synthetic turf fields in a week. It is anticipated that sampling can be performed by 2-person teams, and that each team can collect samples at up to two synthetic fields per week. The EPA WACOR will discuss collection schedules and work capacity with the contractor.

Task 5: - Tire Crumb Rubber Sample Processing, Storage, and Shipment

The contractor shall prepare sampling kits required to implement sample collection and shipping at nine recycling plants following the Research Protocol and SOP. Sampling kits are to include the sample containers, sample collection scoops, gloves and safety glasses, forms provided by EPA as well as and packaging materials. It is anticipated that the sampling kits will fit into two boxes for shipment. The contractor shall pre-label collection bottles and forms with sample ID numbers. The contractor shall ship or transport the sampling kits to a location for use by the field staff for sample collection. The contractor shall provide shipping labels for overnight return shipment of samples to the EPA facility in RTP, NC.

The contractor shall prepare sampling kits required to implement sample collection and shipping at 45 synthetic turf fields following the Research Protocol and SOPs (note that the Research Protocol includes the contingency for sample collection at more than 40 synthetic turf fields). Sampling kits include the sample containers, sample collection devices, gloves and safety glasses, disposable lab coats, forms, ice packs provided by EPA as well as packaging materials. It is anticipated that the sampling kits will fit into three boxes for shipment. The contractor shall pre-label collection bottles and forms with sample ID numbers. The contractor shall ship or transport the sampling kits to a location for use by the field staff for sample collection (including both contractor field staff and U.S. Army field staff). The contractor shall provide shipping labels for overnight return shipment of samples for chemical analysis to the EPA facility in RTP, NC and samples for microbiological analysis to the EPA facility in Cincinnati, OH.

The contractor shall receive and log in tire crumb rubber samples collected from tire recycling plants and synthetic turf fields at the EPA facility in RTP, NC. The contractor shall follow the SOP to prepare composite samples of tire crumb rubber from samples collected at synthetic turf fields. As part of the sub-sample preparation of tire crumb rubber collected at synthetic turf fields, the contractor shall separate out up to 5 g of synthetic grass blades from the tire crumb rubber material and shall store the sample of blades at the EPA RTP laboratory facility. The

contractor shall prepare sub-samples of the tire crumb rubber composite samples from fields and the tire crumb rubber samples from recycling plants following the SOP. The contractor will prepare sub-samples from a subset of 15 individual location synthetic turf field samples, identified by the EPA WACOR, following the SOP.

The contractor shall ship tire crumb rubber samples and sub-samples scheduled for analysis at the EPA facility in Las Vegas, NV by overnight shipment. The contractor shall ship tire crumb rubber sub-samples scheduled for bioaccessibility analysis to a laboratory to be determined by CDC/ATSDR by overnight shipment. The contractor shall provide tire crumb rubber sub-samples for analysis and emissions testing to EPA staff and contractors at the EPA RTP laboratories. The contractor shall store the remainder of all samples under SOP-specified conditions at the EPA RTP laboratory facility in EPA freezers.

The contractor shall prepare and apply the unique sample code labels specified in the SOP to all sample and sub-sample containers. The contractor shall prepare and process all chain-of-custody forms. The contractor shall document all sample preparation activities in a laboratory notebook.

Task 6: Field Sample and Data Collection for the Exposure Characterization Study

The contractor shall implement all aspects of the exposure characterization research activities described in Section 5 of the Research Protocol; except for, (a) urine and blood collection, processing, and shipment protocols; and (b) field user questionnaire administration – both of which will be performed by CDC/ATSDR staff or other contractors. The contractor shall coordinate with CDC/ATSDR staff or other designated contractors as needed to implement the exposure characterization study. The CDC IRB and the EPA Human Subjects Research Review Official have reviewed and approved the Research Protocol.

Up to 45 participants will be recruited by CDC/ATSDR to participate in the exposure measurements portion of the exposure characterization study. The WACOR will provide participant information to the contractor and will communicate with the contractor regarding scheduling. It is anticipated that the participants will be associated with 6 different synthetic turf field locations around the U.S. that are a subset of the fields that participated in the activities described in Tasks 2 – 4. It is anticipated that the exposure measurement study can be implemented for all participants associated with a specific field (up to 7 or 8 participants per field) during a short window of time (for example, over a two- or three-day period) in which each participant will have personal samples collected during and around one on-field activity. Only one set of facility air samples and one set of field wipe, field drag sled, and field dust samples will be collected at each field. It is anticipated that sampling would be performed at only one field a week, and that the work could be performed by a 3- or 4-person team.

Up to 24 of the 45 participants in the exposure measurement study will be recruited by CDC/ATSDR to participate in the video recording activity. Video recording will be performed for these participants (children and adults) during the on-field activity in which their personal samples were collected using EPA-provided video equipment.

The contractor shall follow SOPs to prepare all materials and equipment, provided by EPA, required to implement the exposure characterization study. The contractor shall transport or ship all materials and equipment to each field location. The contractor shall check to ensure that informed consent was obtained from all participants by CDC/ATSDR staff or contractors. The contractor shall implement the facility measurements, personal exposure measurements and video recording following the SOPs. The contractor shall ship or transport all materials, equipment, samples and data to the EPA RTP laboratory. The contractor shall follow all requirements for chain-of-custody and other sample and data documentation. The contractor shall follow all requirements for information data security and privacy protection as described in the Research Protocol and consent forms.

The contractor shall transfer all activity data and records to the EPA WACOR. The contractor shall receive and log in all environmental and personal exposure measurement samples. The contractor shall store all received samples under appropriate storage conditions including in EPA freezers when required. The contractor shall make all samples available to EPA staff and other contractors responsible for further processing and analysis. The contractor shall provide all sample and field collection information, data, and documents to the EPA WACOR.

For costing purposes, the contactor shall assume travel and shipping costs as follows for the exposure measurements study:

- 2 fields in the Northeast U.S. census region
- 2 fields in the South U.S. census region
- 1 field in the Midwest U.S. census region
- 1 field in the West U.S. census region

The actual locations of the sampling locations may differ from this assumed geographical distribution.

QUALITY ASSURANCE

The contractor shall use the Field Sampling and Analysis QAPP provided by EPA. The contractor shall use the Field Sample Collection and Sample Processing SOPs provided by EPA. Some of these SOPs are still in development by EPA. The contractor shall participate in systems and data audits performed by EPA QA staff and contractors. Calibrations of scientific instruments shall be performed under existing SOPs. Standard "good laboratory practices" for maintaining field and laboratory notebooks shall be employed.

DELIVERABLES AND SCHEDULE

Task 1: Tire Crumb Rubber Collection and Shipping from Tire Recycling Plants

The contractor shall begin work immediately. It is anticipated that this effort will be performed in August, 2016 but could extend in to later months in 2016 depending on recruitment success. The contractor shall consult with the EPA WACOR on efficient scheduling for implementation. The contractor shall provide field collection data and records (electronic and hardcopy) to the EPA WACOR within one week of sampling at each recycling plant.

Task 2: Tire Crumb Rubber Collection and Shipping from 20 Synthetic Turf Fields

The contractor shall begin work immediately. It is anticipated that this effort will be performed in August and September, 2016. It is possible the work could extend into later months in 2016 depending on recruitment success and scheduling requirements. The contractor shall consult with the EPA WACOR on efficient scheduling for implementation. The contractor shall provide field collection data and records (electronic and hardcopy) to the EPA WACOR within one week of sampling at each synthetic field.

Task 3: -Optional: Tire Crumb Rubber Collection and Shipping from 5 Additional Synthetic Turf Fields

It is anticipated that this option, if exercised, will be performed in September, 2016. It is possible the work could extend into later months in 2016 depending on recruitment success and scheduling requirements. The contractor shall provide field collection data and records (electronic and hardcopy) to the EPA WACOR within one week of sampling at each synthetic turf field.

Task 4: – Optional: Tire Crumb Rubber Collection from 5 Additional Synthetic Turf Fields

It is anticipated that this option, if exercised, performed in October, 2016. It is possible the work could extend into later months in 2016 depending on recruitment success and scheduling requirements. The contractor shall provide field collection data and records (electronic and hardcopy) to the EPA WACOR within one week of sampling at each synthetic turf field.

Task 5: Tire Crumb Rubber Sample Processing, Storage, and Shipment

The contractor shall begin work immediately. It is anticipated that this effort will be performed August and September, 2016. It is possible the work could extend into later months in 2016 depending on recruitment success and scheduling requirements. The contractor shall provide tire crumb rubber samples and sub-samples to the chamber and analysis laboratories within three days of receipt from each recycling plant and synthetic field sampling event. The contractor shall provide

copies of custody records and sub-sample preparation forms (electronic and hardcopy) to the EPA WACOR within three days of sample receipt from each recycling plant and synthetic field sampling event. The work shall be completed within one week of receipt of the final samples from recycling plants and synthetic turf fields.

Task 6: Field Sample and Data Collection for the Exposure Characterization Study

It is anticipated that the exposure characterization field activity effort will be performed during October and November, 2016. It is possible the work could begin as early as September or extend into later months depending on recruitment success and scheduling requirements. The contractor shall consult with the EPA WACOR on efficient scheduling for implementation. The contractor shall provide samples to the analysis laboratories within one week of receipt from exposure characterization sampling. The contractor shall provide field collection data, activity information, and data (electronic and hardcopy) to the EPA WACOR within one week of receipt from exposure characterization sampling at each field.

STAFFING QUALIFICATIONS

The contractor staff member selected to lead and direct the field sample and data collection activities must have three or more years of experience that includes environmental and/or human exposure measurement field sampling. Contractor staff selected to perform field sampling activities must be sufficiently physically able to implement the SOPs. All contractor staff members engaged in field activities must have any contractor required safety training. All contractor staff members engaged in activities with human research participants in the exposure characterization portions of the study must have any contractor required human subjects training.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-123

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2016
Base Option Period Number 1

Title of Work Assignment/SF Site Name:

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:
See attached PWS with additional details and revisions. Please submit a revised work plan as appropriate.

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Cost/Fee:	LOE:
Contract Period: 04/01/2015 To 03/31/2016		4,612
This Action:		0
Total:		4,612

Work Plan / Cost Estimate Approvals

	Cost/Fee	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Marsha Morgan	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-2598
			FAX Number:
Project Officer Name: Robin S. Harris	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-0955
			FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code:
			Phone Number:
			FAX Number:
Contracting Official Name: Mark Cranley	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-487-2351
			FAX Number: 513-487-2109

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-123

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2016

Option Period Number: 1

Title of Work Assignment/SF Site Name:

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:
See attached PWS with additional details and revisions. Please submit a revised work plan as appropriate.

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A

SFO (Max 2): ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

	Cost/Fee	LOE
Contract Period: 04/01/2015 To 03/31/2016		4,612
This Action:		0
Total:		4,612

Work Plan / Cost Estimate Approvals

	Cost/Fee	LOE
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Marsha Morgan	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-2598
			FAX Number:
Project Officer Name: Robin S. Harris	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-0955
			FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code:
			Phone Number:
			FAX Number:
Contracting Official Name: Matthew J. Growney	Matthew J. Growney (Signature)	9/14/16 (Date)	Branch/Mail Code: CPOD
			Phone Number: 513-487-2
			FAX Number: 513-487-2109

Work Assignment Form. (WebForms v1.0)

Performance Statement of Work

(Revised September 13, 2016)

WA Title: Tire Crumb Rubber Research Field and Laboratory Support

WA Short Title: TCRS Support

WA #: 1-123 Amendment 1 WACOR: Marsha Morgan

Contract #: EP-C-15-008 Alternate WACOR: Kent Thomas

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from August 10, 2016 through March 31, 2017.

SUMMARY OF OBJECTIVES

To provide field sampling and laboratory support for research on synthetic turf fields with tire crumb rubber infill. The contractor shall provide support for sample collections to be performed for the tire crumb rubber characterization and the exposure characterization portions of the research study under the Research Protocol entitled 'Collections Related to Synthetic Turf Fields with Crumb Rubber Infill'. The contractor shall provide laboratory support for material and equipment preparation, sample handling and preparation, and shipping activities.

BACKGROUND

Concerns have been raised by the public about the safety of recycled tire crumb rubber used in synthetic turf fields and playgrounds in the United States (U.S.). Several previous studies have examined human exposure to tire crumb rubber infill in these settings. While, in general, these studies have not provided evidence for these health concerns, the existing studies do not comprehensively evaluate all aspects of exposure associated with these use scenarios. Additional research is needed to help fill important data gaps that will lead to improved exposure assessment and risk evaluation for children and adults using synthetic turf fields and playgrounds with tire crumb rubber. In response, the U.S. Environmental Protection Agency (EPA), the Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry (CDC/ATSDR), and the U.S. Consumer Product Safety Commission (CPSC) have launched a multi-agency federal action plan to study key environmental human health questions associated with tire crumb rubber on synthetic turf fields and playgrounds.

The "Federal Research Action Plan on Recycled Tire Crumb Used on Playing Fields and Playgrounds" (referred to subsequently as the Federal Research Action Plan [FRAP] https://www.epa.gov/chemical-research/federal-research-recycled-tire-crumbs-used-playing-fields) was recently finalized in February 2016. The U.S. EPA and CDC/ATSDR have jointly prepared a Research Protocol to implement portions of these research activities outlined under the FRAP. For this PSOW, major activities to be implemented via the research protocol include:

1) Perform a tire crumb rubber characterization study, and

2) Perform a human exposure characterization study.

The tire crumb rubber characterization study is a pilot-scale effort that will have five main components: First, the study will involve the collection of crumb rubber material from tire recycling plants and synthetic turf fields around the U.S., followed by laboratory analysis of the material for a wide range of metals, volatile organic compounds (VOCs), and semi-volatile organic compounds (SVOCs). Second, laboratory analyses will also include dynamic emission chamber measurements for VOCs and SVOCs in crumb rubber materials under different temperature conditions and bioaccessibility measurements for metals and SVOCs. The emissions and bioaccessibility experiments will provide important information about the types and amounts of chemical constituents in the tire crumb rubber material that are potentially available for human exposure through the inhalation, dermal, and indirect ingestion routes. Third, the study will involve suspect screening and non-targeted analysis methods for unknown VOCs and SVOCs in an attempt to identify other potential chemicals of interest. Fourth, the study will collect tire crumb rubber infill from synthetic turf fields to assess microbial populations. Lastly, this study will identify and collate extant toxicity reference data for selected chemicals of interests identified through the above laboratory analyses.

The exposure characterization study is a pilot-scale effort to: (a) collect information on human activity parameters for synthetic turf field users that affect potential exposures to tire crumb rubber constituents; and (b) implement a human exposure measurement study to further develop and deploy appropriate sample collection methods and to generate data for improved exposure characterization. This data collection will involve adults and children who use synthetic turf fields with tire crumb rubber infill. Information will be collected to provide data about relevant parameters for characterizing and modeling exposures associated with the use of synthetic turf fields. A set of personal and field environment samples will be collected around a sport or training activity performed by participants on a synthetic turf field. Personal (air VOC and dermal wipes for metals and SVOCs) and environmental samples (air VOCs, SVOCs, metals/particulate; field wipe samples for metals and SVOCs; drag sled sampling for SVOCs; and dust for metals and SVOCs). Samples will be analyzed for targeted metal, VOC, and SVOC analytes, and a subset of SVOC samples will undergo non-targeted analysis. A subset of

participants (adults and children) will have video data collection performed during a physical activity (i.e., playing soccer) on a synthetic turf field.

SCOPE

The contractor shall provide technical support to implement specific field sampling and laboratory activities in support of the research described in the Research Protocol. Specific study activities include:

1) Collection and shipment of tire crumb rubber samples from 18 synthetic turf fields.
2) Processing and preparing, nine tire crumb rubber samples and sub-samples from tire recycling plants and synthetic turf fields for analysis and storage.
3) Collection, shipment, and processing of environmental and personal samples, and collection of videographic activity information, in the exposure characterization portion of the study for up to 45 participants at up to 6 fields.

The research design is constrained by a number of factors, most importantly the short timeline for field study completion, with sample collection, analysis, and reporting required by the end of 2016. The very short time frames for sample collection and sample processing are reflected in the Deliverables and Schedule.

The EPA will provide the contractor with the Research Protocol, Quality Assurance Project Plans (QAPPs; Category B), and Standard Operating Procedures (SOPs) relevant to the support activities described with the PWS. Due to the very aggressive timeline for this research some of these documents are still in process. EPA will be responsible for preparing draft and final versions of these documents. contractor recommendations for essential revisions to the QAPP and SOP documents can be provided to, and will be considered by the WACOR. The types of documents and information about their status is provided here:

a) Research Protocol: a final draft version will be provided along with this PWS. The final version, with only minor wording changes, is anticipated to be completed by August 5.

b) QAPPs: Draft QAPPs are anticipated to be available by August 5, 2016. It is likely that the initial QAPPs will be conditionally approved for initial use in the tire crumb characterization portion of the study, with subsequent updating and approval for the exposure characterization portion of the study.

c) SOPs: Draft SOPs for the tire crumb rubber characterization part of the study include sample collection at recycling plants, sample collection at synthetic turf fields, and preparing/processing tire crumb rubber samples. Draft versions of these three SOPs are anticipated to be available by August 5,

2016. Final approved versions of these SOPs are anticipated to be available by August 12, 2016. Draft SOPs for the exposure characterization sample collection are anticipated to be available in late September, with final approved versions available in mid-October, 2016.

At this time, the total number of synthetic turf fields requiring contractor support for sample collection is not exactly known because the success of pending field recruitment is not known.

All field sample collection activities shall be completed by December 17, 2016 regardless of whether the study design goals for numbers of fields and numbers of exposure study participants are met. All activities under this PWS shall be completed by December 31, 2016.

The contractor shall schedule a meeting with the WACOR within 3 business days of receipt of the work assignment package from the Contract Officer.

TECHNICAL APPROACH/OBJECTIVES

Task 1: Tire Crumb Rubber Collection and Shipping from 18 Synthetic Turf Fields

EPA will identify up to 18 synthetic turf fields in the U.S. that use tire crumb rubber as an infill material. The contractor shall collect tire crumb rubber samples at the identified synthetic turf fields following the Research Protocol and SOPs using containers and sampling devices provided by EPA. The contractor shall transport or ship sampling kits prepared by EPA to the field site. The contractor shall ship the samples designated for chemical analysis to the EPA facility in RTP, NC and the samples designated for microbiological analysis to the EPA facility in Cincinnati, OH.

For costing purposes, the contactor shall assume travel and shipping costs as follows:

- 5 fields in the Northeast U.S. census region
- 0 fields in the South U.S. census region
- 10 fields in the Midwest U.S. census region
- 3 fields in the West U.S. census region (note that no fields will be selected in Alaska and Hawaii)

The geographical distributions of fields note above is based on the number to complete a balanced 10 fields per region following Army, EPA, and CDC/ATSDR sampling. However, the actual locations of the synthetic turf fields may differ from this assumed geographical distribution depending on recruitment success. Note that the total number of fields included for sample collection in this PWS is less than the

40 described in the Research Protocol because some fields have been or will be sampled by the U.S. Army and/or EPA and/or CDC/ATSDR staff.

The contractor shall abide by all the terms of the sampling agreement form (see Research Protocol appendix), including all privacy protections. The contractor shall work under collection schedules arranged by the EPA and will alert the WACOR to any scheduling conflicts or difficulties for resolution. It is anticipated that sample collection will be scheduled at up to 4 synthetic turf fields in a week. It is anticipated that sampling can be performed by 2-person teams, and that each team can collect samples at up to two synthetic fields per week. The EPA WACOR will discuss collection schedules and work capacity with the contractor.

Task 2: - Tire Crumb Rubber Sample Processing, Storage, and Shipment

The contractor shall follow the SOP to prepare composite samples of tire crumb rubber from nine samples collected at synthetic turf fields and recycling plants. This represents the number of samples processed by the contractor through September 9, 2016. The contractor will not process any additional samples past that date.

The contractor shall prepare and apply the unique sample code labels specified in the SOP to all nine sets of sample and sub-sample containers. The contractor shall prepare and process all chain-of-custody forms for the nine sets of sub-samples. The contractor shall document all sub-sample preparation activities in a laboratory notebook for the nine sets of sub-samples.

Task 3: Field Sample and Data Collection for the Exposure Characterization Study

The contractor shall implement all aspects of the exposure characterization research activities described in Section 5 of the Research Protocol; except for, (a) urine and blood collection, processing, and shipment protocols; and (b) field user questionnaire administration – both of which will be performed by CDC/ATSDR staff or other contractors. The contractor shall coordinate with CDC/ATSDR staff or other designated contractors as needed to implement the exposure characterization study. The CDC IRB and the EPA Human Subjects Research Review Official have reviewed and approved the Research Protocol.

Up to 45 participants will be recruited by CDC/ATSDR to participate in the exposure measurements portion of the exposure characterization study. The WACOR will provide participant information to the contractor and will communicate with the contractor regarding scheduling. It is anticipated that the participants will be associated with 6 different synthetic turf field locations around the U.S. that are a

subset of the fields that participated in the activities described in Tasks 2 – 4. It is anticipated that the exposure measurement study can be implemented for all participants associated with a specific field (up to 7 or 8 participants per field) during a short window of time (for example, over a two- or three-day period) in which each participant will have personal samples collected during and around one on-field activity. Only one set of facility air samples and one set of field wipe, field drag sled, and field dust samples will be collected at each field. It is anticipated that sampling would be performed at only one field a week, and that the work could be performed by a 3- or 4-person team.

Up to 24 of the 45 participants in the exposure measurement study will be recruited by CDC/ATSDR to participate in the video recording activity. Video recording will be performed for these participants (children and adults) during the on-field activity in which their personal samples were collected using EPA-provided video equipment.

The contractor shall follow SOPs to prepare all materials and equipment, provided by EPA, required to implement the exposure characterization study. The contractor shall transport or ship all materials and equipment to each field location. The contractor shall check to ensure that informed consent was obtained from all participants by CDC/ATSDR staff or contractors. The contractor shall implement the facility measurements, personal exposure measurements and video recording following the SOPs. The contractor shall ship or transport all materials, equipment, samples and data to the EPA RTP laboratory. The contractor shall follow all requirements for chain-of-custody and other sample and data documentation. The contractor shall follow all requirements for information data security and privacy protection as described in the Research Protocol and consent forms.

The contractor shall transfer all activity data and records to the EPA WACOR. The contractor shall receive and log in all environmental and personal exposure measurement samples. The contractor shall store all received samples under appropriate storage conditions including in EPA freezers when required. The contractor shall make all samples available to EPA staff and other contractors responsible for further processing and analysis. The contractor shall provide all sample and field collection information, data, and documents to the EPA WACOR.

For costing purposes, the contactor shall assume travel and shipping costs as follows for the exposure measurements study:

- 2 fields in the Northeast U.S. census region
- 2 fields in the South U.S. census region
- 1 field in the Midwest U.S. census region
- 1 field in the West U.S. census region

The actual locations of the sampling locations may differ from this assumed geographical distribution.

Fewer than 45 participants, and fewer than 6 fields, may be sampled if EPA and CDC/ATSDR are unable to recruit sufficient participants by the December 17, 2016 deadline for completing all field sampling activities.

QUALITY ASSURANCE

The contractor shall use the Field Sampling and Analysis QAPP provided by EPA. The contractor shall use the Field Sample Collection and Sample Processing SOPs provided by EPA. Some of these SOPs are still in development by EPA. The contractor shall participate in systems and data audits performed by EPA QA staff and contractors. Calibrations of scientific instruments shall be performed under existing SOPs. Standard "good laboratory practices" for maintaining field and laboratory notebooks shall be employed.

DELIVERABLES AND SCHEDULE

Task 1: Tire Crumb Rubber Collection and Shipping from 18 Synthetic Turf Fields

The contractor shall begin work immediately. It is anticipated that this effort will be performed in September and October, 2016. It is possible the work could extend into November 2016 depending on recruitment success and scheduling requirements. All field sampling activities shall be completed by December 17, 2016 even if EPA and CDC/ATSDR have not been successful in enrolling all of the 18 fields by that time. The contractor shall consult with the EPA WACOR on efficient scheduling for implementation. The contractor shall provide field collection data and records (electronic and hardcopy) to the EPA WACOR within one week of sampling at each synthetic field.

Task 2: Tire Crumb Rubber Sample Processing, Storage, and Shipment

The contractor has processed nine sets of tire crumb rubber samples through September 9, 2016. The contractor shall not process, store, or ship any additional sets of samples beyond the nine that have been completed.

Task 3: Field Sample and Data Collection for the Exposure Characterization Study

It is anticipated that the exposure characterization field activity effort will be performed during October, November, and December, 2016. All field sampling activities shall be completed by December 17, 2016 even if EPA and CDC/ATSDR have not been successful in enrolling all of the 45 participants and 6 fields by that time. The contractor shall consult with the EPA WACOR on efficient scheduling for implementation. The contractor shall provide samples to the analysis laboratories within one week of receipt from exposure characterization sampling. The contractor shall provide field collection data, activity information, and data (electronic and

hardcopy) to the EPA WACOR within one week of receipt from exposure characterization sampling at each field.

STAFFING QUALIFICATIONS

The contractor staff member selected to lead and direct the field sample and data collection activities must have three or more years of experience that includes environmental and/or human exposure measurement field sampling. Contractor staff selected to perform field sampling activities must be sufficiently physically able to implement the SOPs. All contractor staff members engaged in field activities must have any contractor required safety training. All contractor staff members engaged in activities with human research participants in the exposure characterization portions of the study must have any contractor required human subjects training.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-123

☐ Other ☒ Amendment Number: 000002

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2016

Base Option Period Number 1

Title of Work Assignment/SF Site Name:

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:
The purpose of this amendment is to revise the PWS.

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Marsha Morgan
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-2598
FAX Number:

Project Officer Name Robin S. Harris
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0955
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Statement of Work

(Revised September 13, 2016)

WA Title: Tire Crumb Rubber Research Field and Laboratory Support

WA Short Title: TCRS Support

WA #: 1-123 WACOR: Marsha Morgan

Contract #: EP-C-15-008 Alternate WACOR: Kent Thomas

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from August 1, 2016 through March 31, 2017.

SUMMARY OF OBJECTIVES

To provide field sampling and laboratory support for research on synthetic turf fields with tire crumb rubber infill. The contractor shall provide support for ~~sample~~ the processing and preparing of samples~~collections~~ to be performed for the tire crumb rubber characterization portion and for sample collections to be performed for the exposure characterization portions of the research study under the Research Protocol entitled 'Collections Related to Synthetic Turf Fields with Crumb Rubber Infill'. The contractor shall provide laboratory support for material and equipment preparation, sample handling and preparation, and shipping activities.

BACKGROUND

Concerns have been raised by the public about the safety of recycled tire crumb rubber used in synthetic turf fields and playgrounds in the United States (U.S.). Several previous studies have examined human exposure to tire crumb rubber infill in these settings. While, in general, these studies have not provided evidence for these health concerns, the existing studies do not comprehensively evaluate all aspects of exposure associated with these use scenarios. Additional research is needed to help fill important data gaps that will lead to improved exposure assessment and risk evaluation for children and adults using synthetic turf fields and playgrounds with tire crumb rubber. In response, the U.S. Environmental Protection Agency (EPA), the Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry (CDC/ATSDR), and the U.S. Consumer Product Safety Commission (CPSC) have launched a multi-agency federal action plan to study key environmental human health questions associated with tire crumb rubber on synthetic turf fields and playgrounds.

The "Federal Research Action Plan on Recycled Tire Crumb Used on Playing Fields and Playgrounds" (referred to subsequently as the Federal Research Action Plan [FRAP] https://www.epa.gov/chemical-research/federal-research-recycled-tire-crumbs-used-playing-fields) was recently finalized in February 2016. The U.S. EPA and CDC/ATSDR have jointly prepared a Research Protocol to implement portions of these research activities outlined under the FRAP. For this PSOW, major activities to be implemented via the research protocol include:

1) Perform a tire crumb rubber characterization study (processing and preparing samples, only), and

2) Perform a human exposure characterization study.

~~The tire crumb rubber characterization study is a pilot-scale effort that will have five main components: First, the study will involve the collection of crumb rubber material from tire recycling plants and synthetic turf fields around the U.S., followed by laboratory analysis of the material for a wide range of metals, volatile organic compounds (VOCs), and semi-volatile organic compounds (SVOCs). Second, laboratory analyses will also include dynamic emission chamber measurements for VOCs and SVOCs in crumb rubber materials under different temperature conditions and bioaccessibility measurements for metals and SVOCs. The emissions and bioaccessibility experiments will provide important information about the types and amounts of chemical constituents in the tire crumb rubber material that are potentially available for human exposure through the inhalation, dermal, and indirect ingestion routes. Third, the study will involve suspect screening and non-targeted analysis methods for unknown VOCs and SVOCs in an attempt to identify other potential chemicals of interest. Fourth, the study will collect tire crumb rubber infill from synthetic turf fields to assess microbial populations. Lastly, this study will identify and collate extant toxicity reference data for selected chemicals of interests identified through the above laboratory analyses.~~

The exposure characterization study is a pilot-scale effort to: (a) collect information on human activity parameters for synthetic turf field users that affect potential exposures to tire crumb rubber constituents; and (b) implement a human exposure measurement study to further develop and deploy appropriate sample collection methods and to generate data for improved exposure characterization. This data collection will involve adults and children who use synthetic turf fields with tire crumb rubber infill. Information will be collected to provide data about relevant parameters for characterizing and modeling exposures associated with the use of synthetic turf fields. A set of personal and field environment samples will be collected around a sport or training activity performed by participants on a synthetic turf field. Personal (air VOC and dermal wipes for metals and SVOCs) and environmental samples (air VOCs, SVOCs, metals/particulate; field wipe samples for metals and SVOCs; drag sled sampling for SVOCs; and dust for metals and SVOCs). Samples will be analyzed for targeted metal, VOC, and SVOC analytes, and a subset of SVOC samples will undergo non-targeted analysis. A subset of participants (adults and children) will

have video data collection performed during a physical activity (i.e., playing soccer) on a synthetic turf field.

SCOPE

The contractor shall provide technical support to implement specific field sampling and laboratory activities in support of the research described in the Research Protocol. Specific study activities include:

~~1) Collection and shipment of tire crumb rubber samples from 18 synthetic turf fields.~~

~~2)~~1) Processing and preparing, nine tire crumb rubber samples and sub-samples from tire recycling plants and synthetic turf fields for analysis and storage.

~~3)~~2) Collection, shipment, and processing of environmental and personal samples, and collection of videographic activity information, in the exposure characterization portion of the study for up to 45 participants at up to 6 fields.

The research design is constrained by a number of factors, most importantly the short timeline for field study completion, with sample collection, analysis, and reporting required by the end of 2016. The very short time frames for sample collection and sample processing are reflected in the Deliverables and Schedule.

The EPA will provide the contractor with the Research Protocol, Quality Assurance Project Plans (QAPPs; Category B), and Standard Operating Procedures (SOPs) relevant to the support activities described with the PWS. Due to the very aggressive timeline for this research some of these documents are still in process. EPA will be responsible for preparing draft and final versions of these documents. Contractor recommendations for essential revisions to the QAPP and SOP documents can be provided to, and will be considered by the WACOR. The types of documents and information about their status is provided here:

a) Research Protocol: a final draft version will be provided along with this PWS. The final version, with only minor wording changes, is anticipated to be completed by August 5.

b) QAPPs: Draft QAPPs are anticipated to be available by August 5, 2016. It is likely that the initial QAPPs will be conditionally approved for initial use in the tire crumb characterization portion of the study, with subsequent updating and approval for the exposure characterization portion of the study.

c) SOPs: Draft SOPs for the tire crumb rubber characterization part of the study include sample collection at recycling plants, sample collection at synthetic turf fields, and preparing/processing tire crumb rubber samples. Draft versions of these three SOPs are anticipated to be available by August 5, 2016. Final

approved versions of these SOPs are anticipated to be available by August 12, 2016. Draft SOPs for the exposure characterization sample collection are anticipated to be available in late September, with final approved versions available in mid-October, 2016.

~~At this time, the total number of synthetic turf fields requiring contractor support for sample collection is not exactly known because the success of pending field recruitment is not known.~~

All field sample collection activities shall be completed by December 17, 2016 regardless of whether the study design goals for numbers of fields and numbers of exposure study participants are met. All activities under this PWS shall be completed by December 31, 2016.

The contractor shall schedule a meeting with the WACOR within 3 business days of receipt of the work assignment package from the Contract Officer.

TECHNICAL APPROACH/OBJECTIVES

~~Task 1: Tire Crumb Rubber Collection and Shipping from 18 Synthetic Turf Fields~~

~~EPA will identify up to 18 synthetic turf fields in the U.S. that use tire crumb rubber as an infill material. The contractor shall collect tire crumb rubber samples at the identified synthetic turf fields following the Research Protocol and SOPs using containers and sampling devices provided by EPA. The contractor shall transport or ship sampling kits prepared by EPA to the field site. The contractor shall ship the samples designated for chemical analysis to the EPA facility in RTP, NC and the samples designated for microbiological analysis to the EPA facility in Cincinnati, OH.~~

~~For costing purposes, the contactor shall assume travel and shipping costs as follows:~~

- ~~5 fields in the Northeast U.S. census region~~
- ~~0 fields in the South U.S. census region~~
- ~~10 fields in the Midwest U.S. census region~~
- ~~3 fields in the West U.S. census region (note that no fields will be selected in Alaska and Hawaii)~~

~~*The geographical distributions of fields note above is based on the number to complete a balanced 10 fields per region following Army, EPA, and CDC/ATSDR sampling. However, the actual locations of the synthetic turf fields may differ from this assumed geographical distribution depending on recruitment success. Note that the total number of fields included for sample collection in this PWS is less than the 40 described in the Research Protocol because some fields have been or will be sampled by the U.S. Army and/or EPA and/or CDC/ATSDR staff.*~~

~~The contractor shall abide by all the terms of the sampling agreement form (see Research Protocol appendix), including all privacy protections. The contractor shall work under collection schedules arranged by the EPA and will alert the WACOR to any scheduling conflicts or difficulties for resolution. It is anticipated that sample collection will be scheduled at up to 4 synthetic turf fields in a week. It is anticipated that sampling can be performed by 2-person teams, and that each team can collect samples at up to two synthetic fields per week. The EPA WACOR will discuss collection schedules and work capacity with the contractor.~~

Task 2: - Tire Crumb Rubber Sample Processing, Storage, and Shipment

The contractor shall follow the SOP to prepare composite samples of tire crumb rubber from nine samples collected at synthetic turf fields and recycling plants. This represents the number of samples processed by the contractor through September 9, 2016. The contractor shall not process any additional samples past that date.

The contractor shall prepare and apply the unique sample code labels specified in the SOP to all nine sets of sample and sub-sample containers. The contractor shall prepare and process all chain-of-custody forms for the nine sets of sub-samples. The contractor shall document all sub-sample preparation activities in a laboratory notebook for the nine sets of sub-samples.

Task 3: Field Sample and Data Collection for the Exposure Characterization Study

The contractor shall implement all aspects of the exposure characterization research activities described in Section 5 of the Research Protocol; except for, (a) urine and blood collection, processing, and shipment protocols; and (b) field user questionnaire administration – both of which will be performed by CDC/ATSDR staff or other contractors. The contractor shall coordinate with CDC/ATSDR staff or other designated contractors as needed to implement the exposure characterization study. The CDC IRB and the EPA Human Subjects Research Review Official have reviewed and approved the Research Protocol.

Up to 45 participants will be recruited by CDC/ATSDR to participate in the exposure measurements portion of the exposure characterization study. The WACOR will provide participant information to the contractor and will communicate with the contractor regarding scheduling. It is anticipated that the participants will be associated with 6 different synthetic turf field locations around the U.S. that are a subset of the fields that participated in the activities described in Tasks 2 – 4. It is anticipated that the exposure measurement study can be implemented for all participants associated with a specific field (up to 7 or 8 participants per field) during a short window of time (for example, over a two- or three-day period) in which each participant will have personal samples collected during and around one on-field activity. Only one set of facility air samples and one set of field wipe, field drag sled,

and field dust samples will be collected at each field. It is anticipated that sampling would be performed at only one field a week, and that the work could be performed by a 3- or 4-person team.

Up to 24 of the 45 participants in the exposure measurement study will be recruited by CDC/ATSDR to participate in the video recording activity. Video recording will be performed for these participants (children and adults) during the on-field activity in which their personal samples were collected using EPA-provided video equipment.

The contractor shall follow SOPs to prepare all materials and equipment, provided by EPA, required to implement the exposure characterization study. The contractor shall transport or ship all materials and equipment to each field location. The contractor shall check to ensure that informed consent was obtained from all participants by CDC/ATSDR staff or contractors. The contractor shall implement the facility measurements, personal exposure measurements and video recording following the SOPs. The contractor shall ship or transport all materials, equipment, samples and data to the EPA RTP laboratory. The contractor shall follow all requirements for chain-of-custody and other sample and data documentation. The contractor shall follow all requirements for information data security and privacy protection as described in the Research Protocol and consent forms.

The contractor shall transfer all activity data and records to the EPA WACOR. The contractor shall receive and log in all environmental and personal exposure measurement samples. The contractor shall store all received samples under appropriate storage conditions including in EPA freezers when required. The contractor shall make all samples available to EPA staff and other contractors responsible for further processing and analysis. The contractor shall provide all sample and field collection information, data, and documents to the EPA WACOR.

For costing purposes, the contactor shall assume travel and shipping costs as follows for the exposure measurements study:

- 2 fields in the Northeast U.S. census region
- 2 fields in the South U.S. census region
- 1 field in the Midwest U.S. census region
- 1 field in the West U.S. census region

The actual locations of the sampling locations may differ from this assumed geographical distribution.

Fewer than 45 participants, and fewer than 6 fields, may be sampled if EPA and CDC/ATSDR are unable to recruit sufficient participants by the December 17, 2016 deadline for completing all field sampling activities.

QUALITY ASSURANCE

The contractor shall use the Field Sampling and Analysis QAPP provided by EPA. The contractor shall use the Field Sample Collection and Sample Processing SOPs provided by EPA. Some of these SOPs are still in development by EPA. The contractor shall participate in systems and data audits performed by EPA QA staff and contractors. Calibrations of scientific instruments shall be performed under existing SOPs. Standard "good laboratory practices" for maintaining field and laboratory notebooks shall be employed.

DELIVERABLES AND SCHEDULE

~~Task 1: Tire Crumb Rubber Collection and Shipping from 18 Synthetic Turf Fields~~

~~The contractor shall begin work immediately. It is anticipated that this effort will be performed in September and October, 2016. It is possible the work could extend into November 2016 depending on recruitment success and scheduling requirements. All field sampling activities shall be completed by December 17, 2016 even if EPA and CDC/ATSDR have not been successful in enrolling all of the 18 fields by that time. The contractor shall consult with the EPA WACOR on efficient scheduling for implementation. The contractor shall provide field collection data and records (electronic and hardcopy) to the EPA WACOR within one week of sampling at each synthetic field.~~

Task 2: Tire Crumb Rubber Sample Processing, Storage, and Shipment

The contractor has processed nine sets of tire crumb rubber samples through September 9, 2016. The contractor shall not process, store, or ship any additional sets of samples beyond the nine that have been completed.

Task 3: Field Sample and Data Collection for the Exposure Characterization Study

It is anticipated that the exposure characterization field activity effort will be performed during October, November, and December, 2016. All field sampling activities shall be completed by December 17, 2016 even if EPA and CDC/ATSDR have not been successful in enrolling all of the 45 participants and 6 fields by that time. The contractor shall consult with the EPA WACOR on efficient scheduling for implementation. The contractor shall provide samples to the analysis laboratories within one week of receipt from exposure characterization sampling. The contractor shall provide field collection data, activity information, and data (electronic and hardcopy) to the EPA WACOR within one week of receipt from exposure characterization sampling at each field.

STAFFING QUALIFICATIONS

The contractor staff member selected to lead and direct the field sample and data collection activities must have three or more years of experience that includes

environmental and/or human exposure measurement field sampling. Contractor staff selected to perform field sampling activities must be sufficiently physically able to implement the SOPs. All contractor staff members engaged in field activities must have any contractor required safety training. All contractor staff members engaged in activities with human research participants in the exposure characterization portions of the study must have any contractor required human subjects training.

Performance Statement of Work

(Revised September 13, 2016)

WA Title: Tire Crumb Rubber Research Field and Laboratory Support

WA Short Title: TCRS Support

WA #: 1-123

WACOR: Marsha Morgan

Contract #: EP-C-15-008

Alternate WACOR: Kent Thomas

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from August 1, 2016 through March 31, 2017.

SUMMARY OF OBJECTIVES

To provide field sampling and laboratory support for research on synthetic turf fields with tire crumb rubber infill. The contractor shall provide support for the processing and preparing of samples to be performed for the tire crumb rubber characterization portion and for sample collections to be performed for the exposure characterization portion of the research study under the Research Protocol entitled 'Collections Related to Synthetic Turf Fields with Crumb Rubber Infill'. The contractor shall provide laboratory support for material and equipment preparation, sample handling and preparation, and shipping activities.

BACKGROUND

Concerns have been raised by the public about the safety of recycled tire crumb rubber used in synthetic turf fields and playgrounds in the United States (U.S.). Several previous studies have examined human exposure to tire crumb rubber infill in these settings. While, in general, these studies have not provided evidence for these health concerns, the existing studies do not comprehensively evaluate all aspects of exposure associated with these use scenarios. Additional research is needed to help fill important data gaps that will lead to improved exposure assessment and risk evaluation for children and adults using synthetic turf fields and playgrounds with tire crumb rubber. In response, the U.S. Environmental Protection Agency (EPA), the Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry (CDC/ATSDR), and the U.S. Consumer Product Safety Commission (CPSC) have launched a multi-agency federal action plan to study key environmental human health questions associated with tire crumb rubber on synthetic turf fields and playgrounds.

The "Federal Research Action Plan on Recycled Tire Crumb Used on Playing Fields and Playgrounds" (referred to subsequently as the Federal Research Action Plan [FRAP] https://www.epa.gov/chemical-research/federal-research-recycled-tire-crumbs-used-playing-fields) was recently finalized in February 2016. The U.S. EPA and CDC/ATSDR have jointly prepared a Research Protocol to implement portions of these research activities outlined under the FRAP. For this PSOW, major activities to be implemented via the research protocol include:

1) Perform a tire crumb rubber characterization study (processing and preparing samples, only), and

2) Perform a human exposure characterization study.

The exposure characterization study is a pilot-scale effort to: (a) collect information on human activity parameters for synthetic turf field users that affect potential exposures to tire crumb rubber constituents; and (b) implement a human exposure measurement study to further develop and deploy appropriate sample collection methods and to generate data for improved exposure characterization. This data collection will involve adults and children who use synthetic turf fields with tire crumb rubber infill. Information will be collected to provide data about relevant parameters for characterizing and modeling exposures associated with the use of synthetic turf fields. A set of personal and field environment samples will be collected around a sport or training activity performed by participants on a synthetic turf field. Personal (air VOC and dermal wipes for metals and SVOCs) and environmental samples (air VOCs, SVOCs, metals/particulate; field wipe samples for metals and SVOCs; drag sled sampling for SVOCs; and dust for metals and SVOCs). Samples will be analyzed for targeted metal, VOC, and SVOC analytes, and a subset of SVOC samples will undergo non-targeted analysis. A subset of participants (adults and children) will have video data collection performed during a physical activity (i.e., playing soccer) on a synthetic turf field.

SCOPE

The contractor shall provide technical support to implement specific field sampling and laboratory activities in support of the research described in the Research Protocol. Specific study activities include:

1) Processing and preparing, nine tire crumb rubber samples and sub-samples from tire recycling plants and synthetic turf fields for analysis and storage.

2) Collection, shipment, and processing of environmental and personal samples, and collection of videographic activity information, in the exposure characterization portion of the study for up to 45 participants at up to 6 fields.

The research design is constrained by a number of factors, most importantly the short timeline for field study completion, with sample collection, analysis, and reporting

required by the end of 2016. The very short time frames for sample collection and sample processing are reflected in the Deliverables and Schedule.

The EPA will provide the contractor with the Research Protocol, Quality Assurance Project Plans (QAPPs; Category B), and Standard Operating Procedures (SOPs) relevant to the support activities described with the PWS. Due to the very aggressive timeline for this research some of these documents are still in process. EPA will be responsible for preparing draft and final versions of these documents. Contractor recommendations for essential revisions to the QAPP and SOP documents can be provided to, and will be considered by the WACOR. The types of documents and information about their status is provided here:

a) Research Protocol: a final draft version will be provided along with this PWS. The final version, with only minor wording changes, is anticipated to be completed by August 5.

b) QAPPs: Draft QAPPs are anticipated to be available by August 5, 2016. It is likely that the initial QAPPs will be conditionally approved for initial use in the tire crumb characterization portion of the study, with subsequent updating and approval for the exposure characterization portion of the study.

c) SOPs: Draft SOPs for the tire crumb rubber characterization part of the study include sample collection at recycling plants, sample collection at synthetic turf fields, and preparing/processing tire crumb rubber samples. Draft versions of these three SOPs are anticipated to be available by August 5, 2016. Final approved versions of these SOPs are anticipated to be available by August 12, 2016. Draft SOPs for the exposure characterization sample collection are anticipated to be available in late September, with final approved versions available in mid-October, 2016.

All field sample collection activities shall be completed by December 17, 2016 regardless of whether the study design goals for numbers of fields and numbers of exposure study participants are met. All activities under this PWS shall be completed by December 31, 2016.

The contractor shall schedule a meeting with the WACOR within 3 business days of receipt of the work assignment package from the Contract Officer.

TECHNICAL APPROACH/OBJECTIVES

Task 1~~2~~: - Tire Crumb Rubber Sample Processing, Storage, and Shipment

The contractor shall follow the SOP to prepare composite samples of tire crumb rubber from nine samples collected at synthetic turf fields and recycling plants. This represents the number of samples processed by the contractor through September 9, 2016. The contractor shall not process any additional samples past that date.

The contractor shall prepare and apply the unique sample code labels specified in the SOP to all nine sets of sample and sub-sample containers. The contractor shall prepare and process all chain-of-custody forms for the nine sets of sub-samples. The contractor shall document all sub-sample preparation activities in a laboratory notebook for the nine sets of sub-samples.

Task 2~~3~~: Field Sample and Data Collection for the Exposure Characterization Study

The contractor shall implement all aspects of the exposure characterization research activities described in Section 5 of the Research Protocol; except for, (a) urine and blood collection, processing, and shipment protocols; and (b) field user questionnaire administration – both of which will be performed by CDC/ATSDR staff or other contractors. The contractor shall coordinate with CDC/ATSDR staff or other designated contractors as needed to implement the exposure characterization study. The CDC IRB and the EPA Human Subjects Research Review Official have reviewed and approved the Research Protocol.

Up to 45 participants will be recruited by CDC/ATSDR to participate in the exposure measurements portion of the exposure characterization study. The WACOR will provide participant information to the contractor and will communicate with the contractor regarding scheduling. It is anticipated that the participants will be associated with 6 different synthetic turf field locations around the U.S. that are a subset of the fields that participated in the activities described in Tasks 2 – 4. It is anticipated that the exposure measurement study can be implemented for all participants associated with a specific field (up to 7 or 8 participants per field) during a short window of time (for example, over a two- or three-day period) in which each participant will have personal samples collected during and around one on-field activity. Only one set of facility air samples and one set of field wipe, field drag sled, and field dust samples will be collected at each field. It is anticipated that sampling would be performed at only one field a week, and that the work could be performed by a 3- or 4-person team.

Up to 24 of the 45 participants in the exposure measurement study will be recruited by CDC/ATSDR to participate in the video recording activity. Video recording will be performed for these participants (children and adults) during the on-field activity in which their personal samples were collected using EPA-provided video equipment.

The contractor shall follow SOPs to prepare all materials and equipment, provided by EPA, required to implement the exposure characterization study. The contractor shall also be responsible for providing calibrated high-volume (SVOC) air samplers to be used in the study (see approved SOP). The contractor shall transport or ship all

materials and equipment to each field location. The contractor shall check to ensure that informed consent was obtained from all participants by CDC/ATSDR staff or contractors. The contractor shall implement the facility measurements, personal exposure measurements and video recording following the SOPs. The contractor shall ship or transport all materials, equipment, samples and data to the EPA RTP laboratory. The contractor shall follow all requirements for chain-of-custody and other sample and data documentation. The contractor shall follow all requirements for information data security and privacy protection as described in the Research Protocol and consent forms.

The contractor shall transfer all activity data and records to the EPA WACOR. The contractor shall receive and log in all environmental and personal exposure measurement samples. The contractor shall store all received samples under appropriate storage conditions including in EPA freezers when required. The contractor shall make all samples available to EPA staff and other contractors responsible for further processing and analysis. The contractor shall provide all sample and field collection information, data, and documents to the EPA WACOR.

For costing purposes, the contactor shall assume travel and shipping costs as follows for the exposure measurements study:

- 2 fields in the Northeast U.S. census region
- 2 fields in the South U.S. census region
- 1 field in the Midwest U.S. census region
- 1 field in the West U.S. census region

The actual locations of the sampling locations may differ from this assumed geographical distribution.

Fewer than 45 participants, and fewer than 6 fields, may be sampled if EPA and CDC/ATSDR are unable to recruit sufficient participants by the December 17, 2016 deadline for completing all field sampling activities.

QUALITY ASSURANCE

The contractor shall use the Field Sampling and Analysis QAPP provided by EPA. The contractor shall use the Field Sample Collection and Sample Processing SOPs provided by EPA. Some of these SOPs are still in development by EPA. The contractor shall participate in systems and data audits performed by EPA QA staff and contractors. Calibrations of scientific instruments shall be performed under existing SOPs. Standard "good laboratory practices" for maintaining field and laboratory notebooks shall be employed.

DELIVERABLES AND SCHEDULE

Task 1~~2~~: Tire Crumb Rubber Sample Processing, Storage, and Shipment

The contractor has processed nine sets of tire crumb rubber samples through September 9, 2016. The contractor shall not process, store, or ship any additional sets of samples beyond the nine that have been completed.

Task 2~~3~~: Field Sample and Data Collection for the Exposure Characterization Study

It is anticipated that the exposure characterization field activity effort will be performed during October, November, and December, 2016. All field sampling activities shall be completed by December 17, 2016 even if EPA and CDC/ATSDR have not been successful in enrolling all of the 45 participants and 6 fields by that time. The contractor shall consult with the EPA WACOR on efficient scheduling for implementation. The contractor shall provide samples to the analysis laboratories within one week of receipt from exposure characterization sampling. The contractor shall provide field collection data, activity information, and data (electronic and hardcopy) to the EPA WACOR within one week of receipt from exposure characterization sampling at each field.

STAFFING QUALIFICATIONS

The contractor staff member selected to lead and direct the field sample and data collection activities must have three or more years of experience that includes environmental and/or human exposure measurement field sampling. Contractor staff selected to perform field sampling activities must be sufficiently physically able to implement the SOPs. All contractor staff members engaged in field activities must have any contractor required safety training. All contractor staff members engaged in activities with human research participants in the exposure characterization portions of the study must have any contractor required human subjects training.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-123

☐ Other ☒ Amendment Number: 000004

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2016 To 03/31/2017 Base Option Period Number 1	TCRS Support

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:
The purpose of this amendment is to revise the task of the PWS. Revisions are reflected as track changes in the document. A revised cost estimate (if necessary) and technical memo addressing the PWS revisions are requested within 7 business days.

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2016 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Marsha Morgan	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-2598 FAX Number:
Project Officer Name Robin S. Harris	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-0955 FAX Number:
Other Agency Official Name	(Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Candice Charlton	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2007 FAX Number:

Performance Statement of Work

(Revised November~~September~~ 30~~13~~, 2016)

WA Title: Tire Crumb Rubber Research Field and Laboratory Support

WA Short Title: TCRS Support

WA #: 1-123 WACOR: Marsha Morgan

Contract #: EP-C-15-008 Alternate WACOR: Kent Thomas

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from August 1, 2016 through March 31, 2017.

SUMMARY OF OBJECTIVES

To provide field sampling and laboratory support for research on synthetic turf fields with tire crumb rubber infill. The contractor shall provide support for the processing and preparing of samples to be performed for the tire crumb rubber characterization portion and for sample collections to be performed for the exposure characterization portion of the research study under the Research Protocol entitled 'Collections Related to Synthetic Turf Fields with Crumb Rubber Infill'. The contractor shall provide laboratory support for material and equipment preparation, sample handling and preparation, and shipping activities.

BACKGROUND

Concerns have been raised by the public about the safety of recycled tire crumb rubber used in synthetic turf fields and playgrounds in the United States (U.S.). Several previous studies have examined human exposure to tire crumb rubber infill in these settings. While, in general, these studies have not provided evidence for these health concerns, the existing studies do not comprehensively evaluate all aspects of exposure associated with these use scenarios. Additional research is needed to help fill important data gaps that will lead to improved exposure assessment and risk evaluation for children and adults using synthetic turf fields and playgrounds with tire crumb rubber. In response, the U.S. Environmental Protection Agency (EPA), the Centers for Disease Control and Prevention/Agency for Toxic Substances and Disease Registry (CDC/ATSDR), and the U.S. Consumer Product Safety Commission (CPSC) have launched a multi-agency federal action plan to study key environmental human health questions associated with tire crumb rubber on synthetic turf fields and playgrounds.

The "Federal Research Action Plan on Recycled Tire Crumb Used on Playing Fields and Playgrounds" (referred to subsequently as the Federal Research Action Plan [FRAP] https://www.epa.gov/chemical-research/federal-research-recycled-tire-crumbs-used-playing-fields) was recently finalized in February 2016. The U.S. EPA and CDC/ATSDR have jointly prepared a Research Protocol to implement portions of these research activities outlined under the FRAP. For this PSOW, major activities to be implemented via the research protocol include:

1) Perform a tire crumb rubber characterization study (processing and preparing samples, only), and

2) Perform a human exposure characterization study.

The exposure characterization study is a pilot-scale effort to: (a) collect information on human activity parameters for synthetic turf field users that affect potential exposures to tire crumb rubber constituents; and (b) implement a human exposure measurement study to further develop and deploy appropriate sample collection methods and to generate data for improved exposure characterization. This data collection will involve adults and children who use synthetic turf fields with tire crumb rubber infill. Information will be collected to provide data about relevant parameters for characterizing and modeling exposures associated with the use of synthetic turf fields. A set of personal and field environment samples will be collected around a sport or training activity performed by participants on a synthetic turf field. Personal (air VOC and dermal wipes for metals and SVOCs) and environmental samples (air VOCs, SVOCs, metals/particulate; field wipe samples for metals and SVOCs; drag sled sampling for SVOCs; and dust for metals and SVOCs). Samples will be analyzed for targeted metal, VOC, and SVOC analytes, and a subset of SVOC samples will undergo non-targeted analysis. A subset of participants (adults and children) will have video data collection performed during a physical activity (i.e., playing soccer) on a synthetic turf field.

SCOPE

The contractor shall provide technical support to implement specific field sampling and laboratory activities in support of the research described in the Research Protocol. Specific study activities include:

1) Processing and preparing, nine tire crumb rubber samples and sub-samples from tire recycling plants and synthetic turf fields for analysis and storage.

2) Collection, shipment, and processing of environmental and personal samples, and collection of videographic activity information, in the exposure characterization portion of the study for up to 45 participants at up to 6 fields.

The research design is constrained by a number of factors, most importantly the short timeline for field study completion, with sample collection, analysis, and reporting

required by the end of 2016. The very short time frames for sample collection and sample processing are reflected in the Deliverables and Schedule.

The EPA will provide the contractor with the Research Protocol, Quality Assurance Project Plans (QAPPs; Category B), and Standard Operating Procedures (SOPs) relevant to the support activities described with the PWS. Due to the very aggressive timeline for this research some of these documents are still in process. EPA will be responsible for preparing draft and final versions of these documents. Contractor recommendations for essential revisions to the QAPP and SOP documents can be provided to, and will be considered by the WACOR. The types of documents and information about their status is provided here:

a) Research Protocol: a final draft version will be provided along with this PWS. The final version, with only minor wording changes, is anticipated to be completed by August 5.

b) QAPPs: Draft QAPPs are anticipated to be available by August 5, 2016. It is likely that the initial QAPPs will be conditionally approved for initial use in the tire crumb characterization portion of the study. The draft QAPP for the exposure characterization portion of the study is anticipated to be available by early December 2016.~~, with subsequent updating and approval for the exposure characterization portion of the study~~.

c) SOPs: Draft SOPs for the tire crumb rubber characterization part of the study include sample collection at recycling plants, sample collection at synthetic turf fields, and preparing/processing tire crumb rubber samples. Draft versions of these three SOPs are anticipated to be available by August 5, 2016. Final approved versions of these SOPs are anticipated to be available by August 12, 2016. Draft SOPs for the exposure characterization sample collection are anticipated to be available by~~in~~ early December~~late September~~, with final approved versions available by the end~~in mid-~~ of December~~October~~, 2016.

All field sample collection activities shall be completed by January 31~~December 17~~, 2017~~6~~ (expiration of OMB approval) regardless of whether the study design goals for numbers of fields and numbers of exposure study participants are met. All activities under this PWS shall be completed by February 15~~December 31~~, 2017~~6~~.

The contractor shall schedule a meeting with the WACOR within 3 business days of receipt of the work assignment package from the Contract Officer.

TECHNICAL APPROACH/OBJECTIVES

Task 1: - Tire Crumb Rubber Sample Processing, Storage, and Shipment

The contractor shall follow the SOP to prepare composite samples of tire crumb rubber from nine samples collected at synthetic turf fields and recycling plants. This represents the number of samples processed by the contractor through September 9, 2016. The contractor shall not process any additional samples past that date.

The contractor shall prepare and apply the unique sample code labels specified in the SOP to all nine sets of sample and sub-sample containers. The contractor shall prepare and process all chain-of-custody forms for the nine sets of sub-samples. The contractor shall document all sub-sample preparation activities in a laboratory notebook for the nine sets of sub-samples.

Task 2: Field Sample and Data Collection for the Exposure Characterization Study

The contractor shall implement all aspects of the exposure characterization research activities described in Section 5 of the Research Protocol; except for, (a) urine and blood collection, processing, and shipment protocols; and (b) field user questionnaire administration – both of which will be performed by CDC/ATSDR staff or other contractors. The contractor shall coordinate with CDC/ATSDR staff or other designated contractors as needed to implement the exposure characterization study. The CDC IRB and the EPA Human Subjects Research Review Official have reviewed and approved the Research Protocol.

Up to 45 participants will be recruited by CDC/ATSDR to participate in the exposure measurements portion of the exposure characterization study. The WACOR will provide participant information to the contractor and will communicate with the contractor regarding scheduling. It is anticipated that the participants will be associated with up to 6 different synthetic turf field locations around the U.S. that are a subset of the fields that participated in the activities ~~described~~ for ~~in~~ the Tire Crumb Rubber Characterization study~~Tasks 2 – 4.~~ It is anticipated that the exposure measurement study can be implemented for all participants associated with a specific field (up to 7 or 8 participants per field) during a short window of time (for example, over a two- or three-day period) in which each participant will have personal samples collected during and around one on-field activity. Only one set of facility air samples and one set of field wipe, field drag sled, and field dust samples will be collected at each field. It is anticipated that sampling would be performed at only one field a week, and that the work could be performed by a 3- or 4-person team.

Up to 24 of the 45 participants in the exposure measurement study will be recruited by CDC/ATSDR to participate in the video recording activity. Video recording will be performed for these participants (children and adults) during the on-field activity in which their personal samples were collected using EPA-provided video equipment.

The contractor shall follow SOPs to prepare all materials and equipment, provided by EPA, required to implement the exposure characterization study. ~~The contractor shall also be responsible for providing calibrated high-volume (SVOC) air samplers to be used in the study (see approved SOP).~~ The contractor shall transport or ship all materials and equipment to each field location. The contractor shall check to ensure that informed consent was obtained from all participants by CDC/ATSDR staff or contractors. The contractor shall implement the facility measurements, personal exposure measurements and video recording following the SOPs. The contractor shall ship or transport all materials, equipment, samples and data to the EPA RTP laboratory. The contractor shall follow all requirements for chain-of-custody and other sample and data documentation. The contractor shall follow all requirements for information data security and privacy protection as described in the Research Protocol and consent forms.

Formatted: Strikethrough

The contractor shall transfer all activity data and records to the EPA WACOR. The contractor shall receive and log in all environmental and personal exposure measurement samples. The contractor shall store all received samples under appropriate storage conditions including in EPA freezers when required. The contractor shall make all samples available to EPA staff and other contractors responsible for further processing and analysis. The contractor shall provide all sample and field collection information, data, and documents to the EPA WACOR.

For costing purposes, the contactor shall assume travel and shipping costs as follows for the exposure measurements study:

- 2 fields in the Northeast U.S. census region
- 2 fields in the South U.S. census region
- 1 field in the Midwest U.S. census region
- 1 field in the West U.S. census region

The actual locations of the sampling locations may differ from this assumed geographical distribution.

Fewer than 45 participants, and fewer than 6 fields, may be sampled if EPA and CDC/ATSDR are unable to recruit sufficient participants by the January ~~December 17~~, 2017~~6~~ deadline. After the contractor receives a Federal-wide Assurance (FWA) number, the collection of all field samples shall be completed by January 31, 2017. In addition, the transport/shipping of these field samples and equipment, chain-of-custody and other sample and data documentation, and processing and storage of samples at EPA laboratories shall be completed by February 15, 2017 (Note: no FWA number is required for these specific activities).~~for completing all field sampling activities~~.

QUALITY ASSURANCE

The contractor shall use the Field Sampling and Analysis QAPP provided by EPA. The contractor shall use the Field Sample Collection and Sample Processing SOPs provided by EPA. Some of these SOPs are still in development by EPA. The contractor shall participate in systems and data audits performed by EPA QA staff and contractors. Calibrations of scientific instruments shall be performed under existing SOPs. Standard "good laboratory practices" for maintaining field and laboratory notebooks shall be employed.

DELIVERABLES AND SCHEDULE

Task 1: Tire Crumb Rubber Sample Processing, Storage, and Shipment

The contractor has processed nine sets of tire crumb rubber samples through September 9, 2016. The contractor shall not process, store, or ship any additional sets of samples beyond the nine that have been completed.

Task 2: Field Sample and Data Collection for the Exposure Characterization Study

It is anticipated that the exposure characterization field activity effort will be performed during ~~October, November, and~~ December~~,~~ 2016 and January 2017. All field sampl~~eing~~ collection activities shall be completed by ~~December 17, 2016~~ January 31, 2017 and all other related activities (shipment/transport of field samples and equipment, sample processing/storage etc.) shall be completed by February 15, 2017 -- even if EPA and CDC/ATSDR have not been successful in enrolling all of the 45 participants and 6 fields by that time. The contractor shall consult with the EPA WACOR on efficient scheduling for implementation. The contractor shall provide samples to the analysis laboratories within one week of receipt from exposure characterization sampling. The contractor shall provide field collection data, activity information, and data (electronic and hardcopy) to the EPA WACOR within one week of receipt from exposure characterization sampling at each field.

STAFFING QUALIFICATIONS

The contractor staff member selected to lead and direct the field sample and data collection activities must have three or more years of experience that includes environmental and/or human exposure measurement field sampling. Contractor staff selected to perform field sampling activities must be sufficiently physically able to implement the SOPs. All contractor staff members engaged in field activities must have any contractor required safety training. All contractor staff members engaged in activities with human research participants in the exposure characterization portions of the study must have any contractor required human subjects training.

Performance Statement of Work

WA Title: Cary Test House LCHP

WA #: 1-150 WACOR: Leroy Mickelsen

Contract #: EP-C-15-008 Alternate WACOR: Shannon Serre

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

This work will involve evaluating the sporicidal efficacy of low-concentration hydrogen peroxide vapor (Low-C HP) utilizing a house, the Cary Test House. Low-C HP will be generated in the Cary House using room or house vaporizers or humidifiers. The number, size, placement, and run times of the vaporizers will be the parameters of interest. Tests will be conducted utilizing bacterial spores, the dependent variables (such as *Bacillus atrophaeus* or *Geobacillus stearothermophilus,* surrogates for *Bacillus anthracis*) placed on coupons and those coupons placed into the Cary House. A report shall be drafted of the methods and results.

BACKGROUND

Work will build upon (but not duplicate) similar tests conducted in the COMMANDER. Hydrogen peroxide vapor will be disseminated through the use of either off-the-shelf room or house vaporizers or humidifiers.

SCOPE

Five test runs at the Cary Test House will be made and any additional scoping runs from hydrogen peroxide concentration determinations. Coupons will be prepared and analyzed to determine efficacy. A report will be written summarizing the test set up, treatments, and results.

TECHNICAL APROACH/OBJECTIVES

In the Cary House, decontamination efficacy will be determined based on inactivation of bacterial spores disseminated on coupons and those coupons placed throughout the Cary House. This work assignment covers the efforts related to conducting the decontamination tests as well as all microbiological preparation and analyses work done by the on-site Biolab.

WA SPECIFIC EQUIPMENT

All tasks described in this PWS shall be performed in-house, at the rented Cary House facilities at McDonald Woods, Cary, NC.

QUALITY ASSURANCE

Positive coupon controls, Negative coupon controls, Procedural blank coupon controls, Laboratory coupon controls, Calibration of all test equipment including hydrogen peroxide monitors, and Titration of hydrogen peroxide concentration used.

DELIVERABLES

Results after each test run and drift, monthly reports, and final report after all test runs are complete.

SCHEDULE of DELIVERABLES

Deliverable	Completion Date
Submit work assignment plan	8/15/15
Submit first draft of test/QA Project Plan (review & concur)	8/21/15
Revise test/QA Plan amendment per WAM comments	2 weeks after comments received
Submit draft report	06/30/16
Submit final report based on comments from WAM	2 weeks after comments received

1. Review a previously prepared quality assurance project plan (QAPP), which shall cover the experiments as described in Task 2 of this PWS. To the extent feasible, the QAPP shall be consistent with and based upon existing QATPs, developed under other similar work assignments from previous or current APPCD contracts.

2. Conduct microbiological tasks including the inoculation of coupons, analyze coupons, etc. Estimated at 100 sample coupons per run, for a total estimate of 500 coupons. And an estimate at 60 biological indicators per run, for a total estimate of 300 BIs.

3. Conduct up to five tests in the Cary House utilizing Low-C HP. Tests will determine the log reduction in viable bacterial spores on coupons placed in the Cary House. Subtasks for conducting tests shall include the following:

    - Maintain security of house?
    - Prepare house, set up vaporizers, monitor and record HP concentration in air and ambient meteorological data,

- Place coupons in house, collect coupons after test,

4. Provide general support for maintaining the field equipment and collecting data such as HP air monitoring, temperature, and relative humidity inside and out of the test house; and weather parameters such as wind velocities and precipitation. This support shall include assembly, maintenance, troubleshooting, and configuration for any equipment used for testing. Support shall also include the purchase of any expendable materials, with prior approval from the WAM, for use in this project.

5. Report the results of all tests, including data received from the Biolab (work conducted under the Biolab WA, in support of this WA) to the WAM as soon as possible via email and through other agreed upon means. The WAM shall be notified immediately of any problems encountered with field equipment, the Cary Test House, or in the laboratory or with the results obtained. These data shall include any generated data files (i.e., logged data) properly annotated, reports of the experimental conditions, calibration checks, measured variables, and a listing of the samples awaiting further analysis.

6. Analyze the data per the requirements in the QATP and in consultation with the WAM, and report the results of these analyses as soon as possible via email and through other agreed upon means. The expected data analyses would be in the form of Excel spreadsheets or other appropriate software.

7. Meet with the WAM at least every week to provide a project status update. The update shall include a synopsis of activities taking place the past week, problems encountered, and work planned for the next week.

8. Update the health and safety research protocols, as needed, as required by the EPA Facility and APPCD safety personnel. Updates to these protocols shall be approved by the EPA WAM and safety personnel prior to the commencement of any testing. The contractor shall provide a copy of the health and safety plan to the WAM and the ORD-Safety Office for discussion.

9. Prepare monthly reports to EPA that summarize work activities (accomplished and planned) in this work assignment, including the status of applicable test, QA, and safety plans. The monthly report shall also detail labor costs and ODC charges. The ODC charges shall be documented in the report in a way that the items purchased, vendor, and cost are clearly indicated.

10. Prepare draft and final report summarizing this completed study.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-151

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Leroy Mickelsen	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-1356
			FAX Number:
Project Officer Name Robin Baily	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-7906
			FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code:
			Phone Number:
			FAX Number:
Contracting Official Name Mark Cranley	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-487-2351
			FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Desorption of Methyl Bromide from Various Materials

WA #: WA 1-151 WACOR: Leroy Mickelsen

Contract #: EP-C-15-008

PERIOD OF PERFORMANCE:

The period of performance detailed in the Performance Statement of Work (PSW) shall be from April 1, 2016 through March 31, 2017.

SUMMARY OF OBJECTIVES

The overall objective of this project is to determine desorption parameters of Methyl Bromide (MB) from materials subject to concentrations and conditions found as a result of decontamination activities. This project supports the U. S. Environmental Protection Agency (EPA) Homeland Security Research Program (HSRP).

BACKGROUND

In the event of a release of biological material in an urban area that would require decontamination for the purpose of public safety, the potential of resuspension of said materials is of great interest to EPA and the Department of Homeland Security. In such an event, a wide range of surfaces would be contaminated. The EPA has the responsibility for protecting human health and the environment from secondary emission of materials from these areas and may be required to mitigate, provide consequence management, and decontaminate the area of concern. To this end, the EPA Office of Research and Development, National Homeland Security Research Center (NHSRC) Decontamination and Consequence Management Division (DCMD) and the Office of Emergency Management, CBRN Consequence Management Advisory Division (CMAD) is conducting research to investigate the desorption of MB from materials.

Determination of desorption rates of MB post fumigation is critical to inform property owners of re-entry times for decontaminated structures. The purpose of this work assignment is to provide information to predict safe reentry time. This project will directly support rapid prediction of chemical exposure under HSRP by providing chemical concentrations and other parameters as part of the basic model input.

SCOPE

The Contractor shall experimentally determine the material/air partition coefficients (K) and effective diffusion coefficients (D_e) for MB with different materials under conditions of different relative humidity (RH) and different temperatures after materials have been exposure to MB. The test materials will be provided by EPA WACOR.

TECHNICAL APROACH/OBJECTIVES

The contractor shall conduct the following tasks:

Task 1. Provide the project Work Plan (WP), Quality Assurance Project Plan (QAPP), and Health and Safety Plan (HASP). The WP shall provide a table of deliverables and a timeline for the work to be performed within 30 days of the initiation of this Work Assignment.

In the QAPP please provide the test chamber that will be used, sampling and measurement methods to be followed, and data reduction needed to determine the K and D_e for the materials tested. Also include in the QAPP a testing matrix which includes 3 materials, 2 RHs, 2 temperatures, number of replicates needed, and total number of experiments to be conducted.

Due date: 60 days after initiation of this Work Assignment.

Task 2. Experimentally determine the K and D_e

The Contractor shall experimentally determine the K and D_e for MB with 3 different materials under two different RHs and 2 different temperatures after exposure to 5% v/v MB for 24 hours. The test materials will be provided by EPA WACOR, and are:

- Rubber mat materials used as flooring
- Plastic materials used on interior surfaces of mass transit
- Upholstered foam used in seating

During Task 2 monthly progress reports are required.

Due Date Task 2: To be determined. Task 2 is a future task to be covered in the WP and QAPP but not initiated until the WP and QAPP are approved.

Task 3. Provide written report in EPA report format. Include values and standard deviations for K and D_e in data tables and appropriate conclusions and recommendations.

During Task 3 monthly progress reports are required.

Due Date Task 3: To be determined. Task 3 is a future task to be covered in the WP and QAPP but not initiated until the WP, QAPP, and laboratory work are completed.

QUALITY ASSURANCE

The contractor shall adhere to the EPA QA requirements as delineated at the EPA QA website. Work shall not commence until the quality assurance documentation has received official approval from the EPA Quality Assurance Staff.

DELIVERABLES and SCHEDULE of DELIVERABLES

Work Plan. A work plan containing a cost estimate shall be provided to the Contracting Officer (CO), PO and WACOR within 30 days of the Contracting Officer's signature. A Quality Assurance Project Plan (QAPP) shall be provided within 90 days. The contractor shall prepare a QAPP in accordance with Quality Assurance (QA) Category 3 . Attachment 1 to the Performance Work Statement (PWS) or Statement of Work (SOW) provides information regarding **NHSRC QA Requirements/Definitions List.**

A Category 1 or 2 QAPP must be developed in accordance with the document titled "EPA Requirements for Quality Assurance Project Plans." EPA QA/R-5 can be found at http://www.epa.gov/quality/qs-docs/r5-final.pdf. At the discretion of the COR, a Category 3 QAPP can be either based on the R5 guidance or a project-specific QA requirements provided on the NHSRC@work website. *The appropriate project-specific QA requirement information must be provided by the COR as Attachment 2.*

The QAPP must be approved prior to the start of any literature searches (existing data), data collection, gathering, synthesizing, or data generation (laboratory) work. Additional information related to QA requirements can be found at www.epa.gov/quality.

QA/QC Requirements for WA: Calibrations of scientific instruments shall be performed under existing Standard Operating Procedures. Standard "good laboratory practices" for maintaining notebooks shall be employed.

Special Requirements: The contractor shall modify the work plan to cover all tasks through the WA end date. The hours and costs shall be broken down by tasks

Reports and Meetings:

Need	Meeting Purpose	Frequency
X	to discuss workplan	Once
X	to review data or analyses	Weekly
X	to review monthly cost report	Monthly

Travel/Training Requirements: Travel ☐ is ☒ is not anticipated to be charged under this work assignment. If travel is anticipated, the dates and circumstances necessitating travel chargeable to this work assignment will be specified by Technical Directive. Travel will be reviewed and approved by the WACOR. Requests for travel shall include: (1) name of traveler(s) and job duties, (2) description of circumstances necessitating travel, (3) location of travel, and (4) estimated cost breakdown by categories

Management Controls: See Contract Management Controls.

Staffing Requirements:

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-175

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2017 Base X Option Period Number	1-175

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 4, 6

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2): ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Lewis Weinstock	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3661 FAX Number:
Project Officer Name Robin Baily	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-7906 FAX Number:
Other Agency Official Name	(Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Mark Cranley	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2351 FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Ambient Monitoring Precursor Gas Methods Support

WA #: 1-175 WACOR: Lewis Weinstock

Contract #: EP-C-15-008 Alternate WACOR: Solomon Ricks

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from April 1, 2016 through March 31, 2017.

SUMMARY OF OBJECTIVES

Contractor support is required to assist the OAQPS Ambient Air Monitoring Group (AAMG) with the on-going operation, maintenance, and troubleshooting of trace level analyzers, meteorological equipment, PM monitors and samplers, auto-GC's, and supporting calibration and data acquisition equipment at the AIRS station and in the E-463 monitoring lab. Programmatic objectives include support for ambient methods research, evaluation of standard operating procedures and quality assurance practices, training of federal and state monitoring agency personnel, and support for on-site and national research field studies with partners.

BACKGROUND

Revisions to the ambient monitoring regulations have established requirements for operation of multi-pollutant NCore and near-road stations to support NO2, NOy, CO, O3, and PM including fine particles, coarse particles, black carbon, and ultra-fines. Re-engineering of the PAMS network in 2015 has created a need for new technologies for hourly VOCs, true NO2, carbonyls, and mixing height data. AAMG evaluates many of these new methods to support state/local/tribal training and network operational needs and to ensure the introduction of new technology into the national monitoring inventory.

SCOPE & TECHNICAL APPROACH/OBJECTIVES

Task 1: The contractor shall provide technical support on an as-needed basis for the operation and maintenance of trace level gas analyzers, data acquisition components, continuous and intermittent PM monitors/samplers, and other supporting equipment at the EPA's AIRS facility and in the E-463 lab to maintain research progress in the NCore, near-road, and PAMS networks to support the evaluation of new methods for speciated and continuous PM2.5, PM10-2.5, ultra-fines, continuous VOC's, and other cutting edge methods such as sensors. The contractor shall perform troubleshooting and repair, as necessary, on the research equipment located at AIRS and E-463, and coordinate with EPA staff to ensure completion of regularly scheduled quality control (precision) checks, flow checks, and calibrations. The contractor shall follow established standard operating procedures and other guidance detailed in latest TAD and approved QAPP in the completion of all activities.

Task 2: The contractor shall provide technical support for quality assurance activities including assisting with gas cylinder certifications, ozone standard recertification, mass flow controller certifications, GC retention time calibrations, and provide on-site support for EPA and non-agency QA personnel performing audit activities supporting the NPAP and PEP programs.

Task 3: The contractor shall provide hands-on training, as needed, on the monitoring equipment at AIRS and in the E-463 lab to representatives from State and local regulatory agencies and EPA staff, with particular emphasis on routine and non-routine maintenance procedures and troubleshooting, operation of the data management system, and configuration of automated calibration sequences.

QUALITY ASSURANCE

Contractor shall follow the latest version of the applicable QAPP: Quality Assurance Project Plan for Training in and Evaluation of Ambient Air Monitoring Technologies at the Burdens Creek NCore Monitoring Station, January, 2008.

DELIVERABLES/SCHEDULE

Contractor shall provide progress reports through regular monthly reporting mechanisms. Additionally, bi-weekly meetings will be scheduled to discuss progress, technical issues, training needs, and coordinate site visits with EPA staff; to be scheduled by the WACOR.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-175

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017
Base Option Period Number 1

Title of Work Assignment/SF Site Name:

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: Section 7

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:
The purpose of this amendment is to add hours to continue work under tasks 1 and 3 of the work assignment.

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Lewis Weinstock
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-3661
FAX Number:

Project Officer Name: Robin S. Harris
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0955
FAX Number:

Other Agency Official Name:
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Candice Charlton
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2007
FAX Number:

Performance Statement of Work

WA Title: Ambient Monitoring Precursor Gas Methods Support

WA #: 1-175 WACOR: Lewis Weinstock

Contract #: EP-C-15-008 Alternate WACOR: Solomon Ricks

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from April 1, 2016 through March 31, 2017.

Amendment 1: The purpose of this amendment is to add hours to continue work on tasks 1 and 3 (specifically continuous VOCs, PAMS methods, and training) that has been more complex and time consuming than originally projected.

SUMMARY OF OBJECTIVES

Contractor support is required to assist the OAQPS Ambient Air Monitoring Group (AAMG) with the on-going operation, maintenance, and troubleshooting of trace level analyzers, meteorological equipment, PM monitors and samplers, auto-GC's, and supporting calibration and data acquisition equipment at the AIRS station and in the E-463 monitoring lab. Programmatic objectives include support for ambient methods research, evaluation of standard operating procedures and quality assurance practices, training of federal and state monitoring agency personnel, and support for on-site and national research field studies with partners.

BACKGROUND

Revisions to the ambient monitoring regulations have established requirements for operation of multi-pollutant NCore and near-road stations to support NO2, NOy, CO, O3, and PM including fine particles, coarse particles, black carbon, and ultra-fines. Re-engineering of the PAMS network in 2015 has created a need for new technologies for hourly VOCs, true NO2, carbonyls, and mixing height data. AAMG evaluates many of these new methods to support state/local/tribal training and network operational needs and to ensure the introduction of new technology into the national monitoring inventory.

SCOPE & TECHNICAL APPROACH/OBJECTIVES

Task 1: The contractor shall provide technical support on an as-needed basis for the operation and maintenance of trace level gas analyzers, data acquisition components, continuous and intermittent PM monitors/samplers, and other supporting equipment at the EPA's AIRS facility and in the E-463 lab to maintain research progress in the NCore, near-road, and PAMS networks to support the evaluation of new methods for speciated and continuous PM2.5, PM10-2.5, ultra-fines, continuous VOC's, and other cutting edge methods such as sensors. The contractor shall perform troubleshooting and repair, as necessary, on the research

equipment located at AIRS and E-463, and coordinate with EPA staff to ensure completion of regularly scheduled quality control (precision) checks, flow checks, and calibrations. The contractor shall follow established standard operating procedures and other guidance detailed in latest TAD and approved QAPP in the completion of all activities.

Task 2: The contractor shall provide technical support for quality assurance activities including assisting with gas cylinder certifications, ozone standard recertification, mass flow controller certifications, GC retention time calibrations, and provide on-site support for EPA and non-agency QA personnel performing audit activities supporting the NPAP and PEP programs.

Task 3: The contractor shall provide hands-on training, as needed, on the monitoring equipment at AIRS and in the E-463 lab to representatives from State and local regulatory agencies and EPA staff, with particular emphasis on routine and non-routine maintenance procedures and troubleshooting, operation of the data management system, and configuration of automated calibration sequences.

QUALITY ASSURANCE

Contractor shall follow the latest version of the applicable QAPP: Quality Assurance Project Plan for Training in and Evaluation of Ambient Air Monitoring Technologies at the Burdens Creek NCore Monitoring Station, January, 2008.

DELIVERABLES/SCHEDULE

Contractor shall provide progress reports through regular monthly reporting mechanisms. Additionally, bi-weekly meetings will be scheduled to discuss progress, technical issues, training needs, and coordinate site visits with EPA staff; to be scheduled by the WACOR.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-200

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

SFO (Max 2) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: David Davies
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-4700
FAX Number:

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name:
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Statement of Work (PSW)

Contract # EP-C-15-008
WA # 1-200
Period of Performance: April 1, 2016 through March 31, 2017
WA Title: "ACE Analytical"

(A) ***Goal/Purpose:*** To provide High Resolution Magnetic Sector Field Inductively Coupled Plasma Mass Spectrometry (HR-ICPMS) and Inductively Coupled Plasma/Optical Emission Spectrometry (ICP-OES) analytical support for toxicology and source apportionment studies. Support includes analysis of sample extracts provided by NHEERL, data workup for reporting elemental results in units of ug/m3 and ug/g, and performing source apportionment analysis.

(B) ***Background/Objectives:*** ICP analyses will directly support ACE FY16-17 deliverables for the EPHD division of NHEERL. ICP results will be used to calculate ug/m3 and ug/g concentrations of elements in the ambient PM samples, and identify / quantify the particulate sources. Correlation of PM sources to observed clinical effects is the desired end result of these research projects.

(C) Tasks:

Task 1 – HR-ICPMS Analytical Support for Analysis of PM Sample Digests. The contractor shall analyze extracts provided by EPA on the EPA HR-ICPMS instrument and provide (i) a final data report and (ii) concentration and uncertainty datasets. The estimated number of sample extracts is 600. The contractor shall analyze the extracts following approved multi element analysis EPA ECAB HR-ICPMS SOP 098.1 (Operation and Maintenance of the Element 2 High Resolution Inductively Coupled Plasma Mass Spectrometry Instrument). EPA will provide extraction matrix for calibration standard matching and all required laboratory supplies.

Task 2 – ICP-OES Analytical Support for Analysis of PM Sample Digests. The contractor shall analyze extracts provided by EPA on the EPA ICP-OES instrument and provide (i) a final data report and (ii) concentration and uncertainty datasets. The estimated number of samples is 200. The contractor shall analyze the extracts following approved multi element analysis EPA ECAB ICP-OES SOP 140.1 (Inductively Coupled Plasma Optical Emission Spectroscopic (ICP-OES) Analysis of Elements). EPA will provide extraction matrix for calibration standard matching and all required laboratory supplies.

Task 3 – Convert ICP-MS and ICP-OES Data to ug/m3 and ug/g Units for Source Apportionment and Toxicology Workup. The contractor shall take final data reports from Tasks 1 and 2, and convert the ng/mL units into: 1) ug element/m3 air sampled for source apportionment analysis, and 2) ug element/g PM for toxicology study workup. The estimated number of samples is 800 (600 from Task 1, 200 from Task 2). EPA will provide PM sample collection data and sample prep data for ICP analysis to calculate conversion factors for ug/m3 and ug/g.

Task 4 – Perform Source Apportionment Analysis on Task 1 Samples. The contractor shall take ug/m3 data from Task 3 along with previously determined ion chromatography and carbon fraction analysis ug/m3 data, and generate a source apportionment analysis using EPA Chemical Mass Balance Model (CMB 8.2).

Task 5 – Reporting. The contractor shall provide the WACOR with monthly reports summarizing progress to date on Tasks 1-2 as well as any problems experienced.

(D) Deliverables and Project Schedule, Acceptance Criteria: The contractor shall complete analysis of all samples in Tasks 1 and 2 by February 28, 2017 to meet project milestones.

(E) QA/QC Requirements for WA: The work carried out under this WA is covered by the project specific QAPP entitled "QUALITY ASSURANCE PROJECT PLAN CLEVELAND MULTIPLE AIR POLLUTION STUDY (CMAPS) REVISION NO. 4". Standard "good laboratory practices" for maintaining notebooks shall be employed.

(F) Special Requirements: The contractor shall prepare a full work plan to cover the tasks through the WA end date. The hours and costs shall be broken down by tasks.

(G) Reports and Meetings: The contractor shall provide the WACOR with monthly reports summarizing to date on Tasks 1 and 2 as well as any problems experienced.

(H) Travel/Training Requirements: Travel ☐ is ☒is not anticipated to be charged under this work assignment. If travel is anticipated, the dates and circumstances necessitating travel chargeable to this work assignment will be specified by Technical Directive. Travel will be reviewed and approved by the WACOR. Requests for travel shall include: (1) name of traveler(s) and job duties, (2) description of circumstances necessitating travel, (3) location of travel, and (4) estimated cost breakdown by categories.

(I) Management Controls: See Contract Management Controls.

(J) Staffing Requirements: Contractor(s) must have 10 years of specialized experience analyzing, reporting, and performing source apportionment analysis of ambient PM2.5 environmental samples for trace level metals analysis using ICP methods (must have publication history demonstrating experience in analytical chemistry) and instrument-specific training from the manufacturer.

Similar work has been performed on a previous work assignment with excellent results. The program recommends the Contractor use the same source; a former Alion employee performed the work under Contract No. EP-D-10-070; option 4, Work Assignment No: 5-11, Titled: "Analytical Support for Cleveland Multiple Air Pollutant Study (CMAPS).

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-201

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name David Davies	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-4700
			FAX Number:
Project Officer Name Robin Baily	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-7906
			FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code:
			Phone Number:
			FAX Number:
Contracting Official Name Mark Cranley	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-487-2351
			FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Cell Culture Exposure System (CCES) Development

WA #: 1-201 WACOR: David W. Davies

Contract #: EP-C-15-008 Alternate WACOR: N/A

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

32 Cell Culture Exposure Systems (CCES) comprised of 32 *in vitro* exposure chambers and the purchase of equipment and instrumentation to generate, control and monitor exposure test atmospheres. The final assembly, testing, and verification of CCES devices, equipment and instrumentation will be performed by the Inhalation Toxicology Facilities Branch (ITFB).

BACKGROUND

ITFB, of the Environment Public Health Division (EPHD) of the National Health & Environmental Effects Lab (NHEERL) of the Office of Research Development (ORD) has been designing and developing the CCES devices that are *in vitro* exposure chambers used to expose various cell cultures to generated test atmospheres to determine different biological effects. This innovative research project has progressed to the stage that fabricating the CCES devices are required utilizing the National Risk Management Research Laboratory's (NRMRL) machine shop, contracted through Jacobs Technology Incorporated (JTI). Once the CCES are fabricated, specific equipment and instrumentation will be purchased by JTI. Final assembly of generation, control, monitoring, and recording systems, needed to conduct exposures to test atmospheres, will be performed by ITFB staff. Of particular importance, are instruments that can count and classify by particle size in real time. The combination of the fabricated *in-vitro* exposure chambers with the purchase of the specified equipment is imperative to assembling the multiple CCES.

The key utility of the CCES will be coupling multiple units to a nose-only animal inhalation exposure chamber. This combination allows for the novel evaluation of a test atmosphere using multiple cell lines and animal models on the same exposure system. This approach allows for biological endpoint validation between *in-vitro* and *in-vivo* test systems. The CCES can be used to test a variety of atmospheres including simulated ambient pollution, hazardous ambient pollutants, volatile chemical compounds, and nano-particles in a "medium through-put" exposure design.

SCOPE

The ITFB has been pursuing this research program for several years under ORD Pathfinder Innovation Project (PIP) PIP2 and PIP4 awards. Once the CCES has been fully developed, tested and verified for both six and 24-well cell culture plates it is anticipated ACE and CSS Research Programs will utilize the CCES under their Research Action Plans (RAPs). The ITFB developed CCES would be expected, as animal inhalation exposures have been for almost 40 years, to be utilized by researchers in several Health Divisions of NHEERL and across ACE and CSS Programs. In addition, many other external entities including NIOSH, NIEHS, FDA, Contract Research Organizations and private corporations have expressed a great deal of interest in the potential usefulness of the CCES.

TECHNICAL APROACH/OBJECTIVES

The technical approach will be to provide finalized mechanical drawings developed by the EPA's in-house machinist in the Program Operations Staff unit of NHEERL to the NMRML contracted (JTI) machine shop who have the automated machinery and operators necessary to fabricate 32 *in-vitro* exposure chambers. They will also purchase the supporting instrumentation and equipment to generate, control, monitor, and record the test atmospheres from the Hamner Research Institute. The Hamner, until recently operated a nationally recognized animal inhalation exposure facility, terminated that program and in the process of disposing all of the instrumentation and equipment associated with the inhalation facility and program.

WA SPECIFIC EQUIPMENT

Attached is the Hamner quote that specifies the instrumentation and equipment needed to operate the fabricated *in vitro* chambers; these items are critical for the assembly of the CCES.

QUALITY ASSURANCE

The chambers will be machined to specifications stated in the provided engineering and mechanical drawings. All machining parameters must be with those specified tolerances.

DELIVERABLES

32 *in vitro* exposure chambers will be fabricated to the specifications provided by ITFB and the Programs Operations Staff. The specified equipment will be purchased from the Hamner and delivered to support operation of the CCES.

SCHEDULE of DELIVERABLES

The *in-vitro* exposure chambers will be delivered in stages with the 6 well *in-vitro* exposure chambers by September 1, 2016 and the 24-well *in-vitro* exposure chambers by March 31, 2017.

The instruments and equipment will be delivered one month after award of this work assignment.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-300

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name David Murphy
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Project Officer Name Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Technical Support for NCCT

WA #: 1-300 WACOR: David Murphy

Contract #: EP-C-15-008 Alternate WACOR: Sandra Roberts

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

The purpose of this requirement is to obtain contractor support for the machining of two injection molding tools (one tool each for a 96-well lid design and a 384-well lid design) and for production runs with each tool to produce finished polystyrene parts.

BACKGROUND

EPA's National Center for Computational Toxicology coordinates the Computational Toxicology Research Program (CompTox), which is part of EPA's broader Chemical Safety for Sustainability (CSS) research efforts. Chemicals are a lynchpin of innovation in the American economy. Moving toward sustainable development requires designing, producing, and using chemicals in safer ways. Information and methods are needed to make better-informed, more-timely decisions about chemicals. The EPA's CompTox and CSS research program is designed to meet this challenge. Current chemical testing is expensive and time consuming, only a small fraction of chemicals have been fully evaluated for potential adverse human health effects. CompTox is working to figure out how to change the current approach used to evaluate the safety of chemicals. CompTox research integrates advances in biology, biotechnology, chemistry, and computer science. Automated chemical screening technologies (called "high-throughput screening assays") and informatics are being used to screen thousands of chemicals and identify important biological processes that may be disrupted by chemicals. Mathematical and advanced computer models are being developed to trace those disruptions to a related dose and human exposure and help link perturbations in biological processes to adverse health impacts. The combined information helps prioritize chemicals based on potential human health risks. Using CompTox, thousands of chemicals can be evaluated for potential risk at a small cost in a very short amount of time while also limiting the number of laboratory animal-based tests.

CompTox researchers have recently developed a method to retrofit ToxCast assays with metabolically-active, human liver homogenates (S9). This new method uses alginate to immobilize and encapsulate human S9. Deployment of this new approach to incorporate metabolism into ToxCast assays requires the manufacturing of custom-designed, polystyrene microplate lids with solid supports for alginate immobilization of S9 that would replace the standard 96- and 384-well microplate lids used by ToxCast partners.

SCOPE

TASKING AREAS – The following tasks fall under contract level SOW section 6.0 Instrumentation and Electronics

Task 1: Tool design and machining

The Contractor shall design and machine two injection molding tools (one each for a 96-well lid design and a 384-well lid design). Tool design performed by the contractor shall include injection and ejection mold plates, and any necessary vents, cooling ports, sprues, gates, runners, boxes, bars, plates, bushings, and/or rings needed to produce the parts specified in the design files provided by EPA. Each tool shall be constructed from a material (selected by the contractor) suitable for the production of a maximum of 20,000 parts per tool. The shrinkage factor (for polystyrene parts), hardness of materials used, and surface finish must be specified in the final tool design and communicated to EPA before machining can begin. EPA must approve mold design prior to start of construction. Timelines and progress must be clearly communicated to EPA during this process. The design and machining of the tools shall not exceed 90 days from the work plan approval date. EPA shall retain ownership of the molding tools; however, the molding tools shall be stored for up to five years from the work plan approval date at a facility maintained by the Contractor for the production of parts (Task 2) to ensure long-term storage requirements are properly met.

Task 2: Pilot production

The Contractor shall employ the injection molding tools to produce a pilot batch of finished parts specified in the design files provided by EPA made from clear, high-heat, crystal grade polystyrene (i.e. Styrolution 1300, Ineos Styrenics 158K or similar material). The purpose of the pilot production is to ensure that the parts resulting from the tools and the injection molding process are of sufficient quality before a larger production is executed. A pilot order shall consist of no fewer than 100 96-well parts and 100 384-well parts. Each part shall be individually packaged in either a sterilization pouch (Fisher Scientific part # 01-812-54) or a packaging material provided by the Contractor suitable for subsequent ethylene oxide (EtO) or hydrogen peroxide gas plasma sterilization. The pilot order of parts shall be completed and shipped within 30 days after construction of the molding tools.

The EPA shall perform functional testing of the pilot parts to ensure proper immobilization of alginate-encapsulated enzymes and that the parts are sufficiently decontaminated by sterilization performed by EPA within 90 days of receipt of pilot parts.

If the pilot parts fail either the sterilization or functional immobilization checks, the EPA and contractor must work to find a solution such as an alternative polystyrene material/blend or textured mold surface to ensure proper part performance. Costs associated with correcting failures due to the manufacturing or sterilization process are the responsibility of the contractor.

Task 3: Initial part production

The Contractor shall employ the injection molding tools to produce finished parts specified in the design files provided by EPA made from clear, high-heat, crystal grade polystyrene (i.e. Styrolution 1300, Ineos Styrenics 158K or similar material). An initial order of 1,000 96-well parts and 2,000 384-well parts shall be produced. Each part shall be individually packaged in either a sterilization pouch (Fisher Scientific part # 01-812-54) or a packaging material provided by the Contractor suitable for subsequent ethylene oxide (EtO) or hydrogen peroxide gas plasma sterilization. The initial order of parts shall be shipped no less than 60 days after EPA approval of pilot parts. Additional part orders may be required using the molds but the additional parts are not part of this statement of work.

TECHNICAL APROACH/OBJECTIVES

The Contractor shall furnish all resources including the necessary personnel, material, equipment, services, and facilities to perform the tasks outlined in the Statement of Work. This includes general work assignment management and oversight functions such as meetings and teleconferences with EPA to review issues, problems, and performance.

The EPA will provide design files for 96-well and 384-well lids in .stl and .stp format.

The Contractor shall design and machine the injection molding tools to accommodate the parts specified in the EPA lid design.

The Contractor shall use the injection molding tools to produce finished parts made from clear, high-heat, crystal grade polystyrene (i.e. Styrolution 1300, Ineos Styrenics 158K or similar material) suitable for cell culture applications.

Performance shall be closely coordinated with EPA staff throughout the process. This coordination shall be facilitated through meetings or teleconferences between contractor staff, EPA Contracting Officer Representative(s) (COR) and other EPA

staff as appropriate, beginning upon approval of the workplan. At these meetings, the following issues will be discussed:

- Overall project planning, progress and scheduling
- Questions related to tool design
- Questions related to part production
- Quality control/quality assurance issues for finished parts

WA SPECIFIC EQUIPMENT – N/A

QUALITY ASSURANCE

1. The Contractor shall include qualitative criteria for the decision to pass or fail each finished part.
2. Finished parts should be of the same shape and dimensions as those specified in the design files provided by EPA ± tolerance due to molding and shrinkage agreed upon during the design process (Task 1).
3. Finished parts should be free of defects including, but not limited to:
    a. Bubbles
    b. Blistering
    c. Streaks/splay marks
    d. Jetting
    e. Short shot
    f. Flow marks
    g. Color steaks
    h. Weld lines
    i. Flash/burrs
    j. Delamination
    k. Stringiness
    l. Sink marks/shrink voids
    m. Warping/twisting
    n. Air trap
    o. Burn marks
    p. Flow lines
    q. Cracks
    r. Fish eyes

A minimal amount of defects that do not affect the function may be acceptable but shall be at the discretion of the Government. Defects that affect the function shall not be accepted. EPA may reject production batch if part defects impacting sterilization of performance exceeds 5%.

DELIVERABLES

1. The Contractor shall deliver molding tools designs for 96-well and 384-well tools.
2. The Contractor shall deliver machined 96-well and 384-well molding tools.
3. The Contractor shall deliver pilot order of at least 100 96-well parts and 100 384-well parts.
4. The Contractor shall deliver the initial order of 1,000 96-well parts and 2,000 384-well parts.

SCHEDULE of DELIVERABLES

1. The contractor shall respond with a work plan within 15 days of issuance of the work assignment.
2. The Contractor shall present EPA with molding tools designs for 96-well and 384-well tools within 30 days of the approval of the work plan.
3. The Contractor shall complete machining of 96-well and 384-well molding tools within 60 days of the molding tools design approval.
4. The Contractor shall deliver pilot order of at least 100 96-well parts and 100 384-well parts within 30 days of molding tool construction.
5. The Contractor shall deliver the initial order of 1,000 96-well parts and 2,000 384-well parts within 60 days after EPA approval of pilot parts.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-300

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2016

Base Option Period Number: 1

Title of Work Assignment/SF Site Name:

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW:

Purpose:
- ☐ Work Assignment
- ☒ Work Assignment Amendment
- ☐ Work Plan Approval
- ☐ Work Assignment Close-Out
- ☐ Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:
The purpose of this amendment is to revise the PWS with additional task.

☐ Superfund — Accounting and Appropriations Data — ☒ Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: David Murphy
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Project Officer Name: Robin Baily
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-7906
FAX Number:

Other Agency Official Name:
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Contracting Official Name: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Statement of Work

WA Title: Technical Support for NCCT

WA #: 1-300 WACOR: David Murphy

Contract #: EP-C-15-008 Alternate WACOR: Sandra Roberts

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

The purpose of this requirement is to obtain contractor support for the machining of four injection molding tools: one tool each for a 96-well lid, a 384-well lid, a 12-trough plate and a 24-trough plate and for production runs with each tool to produce finished polystyrene parts.

BACKGROUND

EPA's National Center for Computational Toxicology coordinates the Computational Toxicology Research Program (CompTox), which is part of EPA's broader Chemical Safety for Sustainability (CSS) research efforts. Chemicals are a lynchpin of innovation in the American economy. Moving toward sustainable development requires designing, producing, and using chemicals in safer ways. Information and methods are needed to make better-informed, more-timely decisions about chemicals. The EPA's CompTox and CSS research program is designed to meet this challenge. Current chemical testing is expensive and time consuming, only a small fraction of chemicals have been fully evaluated for potential adverse human health effects. CompTox is working to figure out how to change the current approach used to evaluate the safety of chemicals. CompTox research integrates advances in biology, biotechnology, chemistry, and computer science. Automated chemical screening technologies (called "high-throughput screening assays") and informatics are being used to screen thousands of chemicals and identify important biological processes that may be disrupted by chemicals. Mathematical and advanced computer models are being developed to trace those disruptions to a related dose and human exposure and help link perturbations in biological processes to adverse health impacts. The combined information helps prioritize chemicals based on potential human health risks. Using CompTox, thousands of chemicals can be evaluated for potential risk at a small cost in a very short amount of time while also limiting the number of laboratory animal-based tests.

CompTox researchers have recently developed a method to retrofit ToxCast assays with metabolically-active, human liver homogenates (S9). This new method uses alginate to immobilize and encapsulate human S9. Deployment of this new approach to incorporate metabolism into ToxCast assays requires the manufacturing of custom-designed, polystyrene microplate lids with solid supports for alginate immobilization of S9 that would replace the standard 96- and 384-well microplate lids used by ToxCast partners.

SCOPE

TASKING AREAS – The following tasks fall under contract level SOW section 6.0 Instrumentation and Electronics

Task 1: Tool design and machining

The Contractor shall design and machine four injection molding tools: one tool each for a 96-well lid, a 384-well lid, a 12-trough plate and a 24-trough plate. Tool design performed by the contractor shall include injection and ejection mold plates, and any necessary vents, cooling ports, sprues, gates, runners, boxes, bars, plates, bushings, and/or rings needed to produce the parts specified in the design files provided by EPA. Each tool shall be constructed from a material (selected by the contractor) suitable for the production of a maximum of 20,000 parts per tool. The shrinkage factor (for polystyrene parts), hardness of materials used, and surface finish must be specified in the final tool design and communicated to EPA before machining can begin. EPA must approve mold design prior to start of construction. Timelines and progress must be clearly communicated to EPA during this process. The design and machining of the tools shall not exceed 90 days from the work plan approval date. EPA shall retain ownership of the molding tools; however, the molding tools shall be stored for up to five years from the work plan approval date at a facility maintained by the Contractor for the production of parts (Task 2) to ensure long-term storage requirements are properly met.

Task 2: Pilot production

The Contractor shall employ the injection molding tools to produce a pilot batch of finished parts specified in the design files provided by EPA made from clear, high-heat, crystal grade polystyrene (i.e. Styrolution 1300, Ineos Styrenics 158K or similar material). The purpose of the pilot production is to ensure that the parts resulting from the tools and the injection molding process are of sufficient quality before a larger production is executed. A pilot order shall consist of no fewer than 100 each of the four parts. Each part shall be individually packaged in either a sterilization pouch (Fisher Scientific part # 01-812-54) or a packaging material provided by the Contractor suitable for subsequent ethylene oxide (EtO) or hydrogen peroxide gas plasma sterilization. The pilot order of parts shall be completed and shipped within 30 days after construction of the molding tools.

The EPA shall perform functional testing of the pilot parts to ensure proper immobilization of alginate-encapsulated enzymes and that the parts are sufficiently decontaminated by sterilization performed by EPA within 90 days of receipt of pilot parts.

If the pilot parts fail either the sterilization or functional immobilization checks, the EPA and contractor must work to find a solution such as an alternative polystyrene material/blend or textured mold surface to ensure proper part performance. Costs associated with correcting failures due to the manufacturing or sterilization process are the responsibility of the contractor.

Task 3: Initial part production

The Contractor shall employ the injection molding tools to produce finished parts specified in the design files provided by EPA made from clear, high-heat, crystal grade polystyrene (i.e. Styrolution 1300, Ineos Styrenics 158K or similar material). An initial order of: 1) 1,000 96-well lids, 2) 2,000 384-well lids, 3) 1,000 12-trough plates and 4) 4,500 24-through plates shall be produced. Each part shall be individually packaged in either a sterilization pouch (Fisher Scientific part # 01-812-54) or a packaging material provided by the Contractor suitable for subsequent ethylene oxide (EtO) or hydrogen peroxide gas plasma sterilization. The initial order of parts shall be shipped no less than 60 days after EPA approval of pilot parts. Additional part orders may be required using the molds but the additional parts are not part of this statement of work.

TECHNICAL APROACH/OBJECTIVES

The Contractor shall furnish all resources including the necessary personnel, material, equipment, services, and facilities to perform the tasks outlined in the Statement of Work. This includes general work assignment management and oversight functions such as meetings and teleconferences with EPA to review issues, problems, and performance.

The EPA will provide design files for each of the four parts in .stl and .stp format.

The Contractor shall design and machine the injection molding tools to accommodate the parts specified in the EPA lid design.

The Contractor shall use the injection molding tools to produce finished parts made from clear, high-heat, crystal grade polystyrene (i.e. Styrolution 1300, Ineos Styrenics 158K or similar material) suitable for cell culture applications.

Performance shall be closely coordinated with EPA staff throughout the process. This coordination shall be facilitated through meetings or teleconferences between

contractor staff, EPA Contracting Officer Representative(s) (COR) and other EPA staff as appropriate, beginning upon approval of the workplan. At these meetings, the following issues will be discussed:

- Overall project planning, progress and scheduling
- Questions related to tool design
- Questions related to part production
- Quality control/quality assurance issues for finished parts

WA SPECIFIC EQUIPMENT – N/A

QUALITY ASSURANCE

1. The Contractor shall include qualitative criteria for the decision to pass or fail each finished part.
2. Finished parts should be of the same shape and dimensions as those specified in the design files provided by EPA ± tolerance due to molding and shrinkage agreed upon during the design process (Task 1).
3. Finished parts should be free of defects including, but not limited to:
    a. Bubbles
    b. Blistering
    c. Streaks/splay marks
    d. Jetting
    e. Short shot
    f. Flow marks
    g. Color steaks
    h. Weld lines
    i. Flash/burrs
    j. Delamination
    k. Stringiness
    l. Sink marks/shrink voids
    m. Warping/twisting
    n. Air trap
    o. Burn marks
    p. Flow lines
    q. Cracks
    r. Fish eyes

A minimal amount of defects that do not affect the function may be acceptable but shall be at the discretion of the Government. Defects that affect the function shall not be accepted. EPA may reject production batch if part defects impacting sterilization of performance exceeds 5%.

DELIVERABLES

1. The Contractor shall deliver molding tools designs for 96-well lid, 384-well lid, 12-trough plate and 24-trough plate tools.
2. The Contractor shall deliver machined 96-well lid, 384-well lid, 12-trough plate and 24-trough plate molding tools.
3. The Contractor shall deliver pilot order of at least 100 each of 96-well lid, 384-well lid, 12-trough plate and 24-trough plate parts.
4. The Contractor shall deliver the initial order of: 1) 1,000 96-well lids, 2) 2,000 384-well lids, 3) 1,000 12-trough plates and 4) 4,500 24-through plates.

SCHEDULE of DELIVERABLES

1. The contractor shall respond with a work plan within 15 days of issuance of the work assignment.
2. The Contractor shall present EPA with molding tools designs for 96-well lid, 384-well lid, 12-trough plate and 24-trough plate tools within 30 days of the approval of the work plan.
3. The Contractor shall complete machining of 96-well lid, 384-well lid, 12-trough plate and 24-trough plate molding tools within 60 days of the molding tools design approval.
4. The Contractor shall deliver pilot order of at least 100 each of 96-well lid, 384-well lid, 12-trough plate and 24-trough plate parts within 30 days of molding tool construction.
5. The Contractor shall deliver the initial order of: : 1) 1,000 96-well lids, 2) 2,000 384-well lids, 3) 1,000 12-trough plates and 4) 4,500 24-through plates within 60 days after EPA approval of pilot parts.

Performance Statement of Work

WA Title: NCCT Laboratory Support

WA #: 1-301 WACOR: David Murphy

Contract #: EP-C-15-008 Alternate WACOR: Sandra Roberts

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

The National Center for Computational Toxicology (NCCT) conducts research to identify, develop and implement alternative toxicity testing methods as part of the Agency's Chemical Safety for Sustainability (CSS) research program. Technical support is needed which will include (1) the design and preparation of laboratory studies, (2) stand-up of the NCCT laboratories, (3) quality assurance laboratory support, (4) instrumentation and electronics support, and (5) preparation of reports or presentations.

BACKGROUND

EPA's National Center for Computational Toxicology coordinates the Computational Toxicology Research Program (CompTox), which is part of EPA's broader Chemical Safety for Sustainability (CSS) research efforts. Chemicals are a lynchpin of innovation in the American economy. Moving toward sustainable development requires designing, producing, and using chemicals in safer ways. Information and methods are needed to make better-informed, more-timely decisions about chemicals. The EPA's CompTox and CSS research program is designed to meet this challenge. Current chemical testing is expensive and time consuming, only a small fraction of chemicals have been fully evaluated for potential adverse human health effects. CompTox is working to figure out how to change the current approach used to evaluate the safety of chemicals. CompTox research integrates advances in biology, biotechnology, chemistry, and computer science. Automated chemical screening technologies (called "high-throughput screening assays") and informatics are being used to screen thousands of chemicals and identify important biological processes that may be disrupted by chemicals. Mathematical and advanced computer models are being developed to trace those disruptions to a related dose and human exposure and help link perturbations in biological processes to adverse health impacts. The combined information helps prioritize chemicals based on potential human health risks. Using CompTox, thousands of chemicals can be evaluated for potential risk at a small cost in a very short amount of time while also limiting the number of laboratory animal-based tests.

SCOPE

The contractor shall carry out activities related to the support of operation of the NCCT's laboratory. The contractor shall carry out only those tasks identified as not inherently governmental in nature.

TECHNICAL APROACH/OBJECTIVES

Task 1. Technical support for the NCCT Laboratory

The contractor shall provide for the design and preparation of laboratory studies. In support of these activities the contractor may be tasked to design, assemble, operate, maintain, repair, and modify laboratory, bench, and pilot-scale experimental units. This task may involve designing, fabricating, or otherwise providing specialized tools, reagents, or other laboratory equipment and consumables. To accommodate these tasks, the WA COR will issue a written technical directive to the contractor for efforts that fall within scope of this task, with copies furnished to the Project Officer (PO) and to the Contract Officer (CO). Each such technical directive will identify the details of the specific project, specify any special conditions, and identify the target date by which the deliverable(s) are to be provided to the WA COR.

Task 2. Laboratory Stand-Up

The contractor shall provide technical and administrative assistance during the stand-up phase of the NCCT laboratory. NCCT currently has approximately 700 sf of lab space which will be increased to approximately 1,800 sf in FY 2017. The contractor shall assist the EPA lab personnel with identifying and obtaining lab equipment and other supplies to ensure efficient operation of the lab. This task may involve providing recommendation for bench set-up, workflow, ergonomics, or other areas to increase efficiency.

Task 3. Quality Assurance Laboratory Support

The contractor shall provide ongoing support to ensure that instrumentation be maintained in good working condition and that it be checked regularly to ensure that it produces reliable data. This support may include checking, auditing or calibrating EPA measurement instrumentation as well as providing performance evaluation audits. For calibration services, the contractor shall be accredited to ISO 17025 *General requirements for the competence of testing and calibration laboratories*.

Task 4. Instrumentation and Electronics

The contractor shall provide ongoing support for NCCT's lab instrumentation and electronics. This support may include development, modification, fabrication, calibration, repair, design, and maintenance of NCCT's lab equipment. This support may include process instrumentation, laboratory instrument, computer interfaces, and sampling equipment. The contractor may be tasked to design and fabricate new instruments or prototype devices. This may involve developing engineering drawings or sketches, and fabricating prototype devices.

Task 5. Development of Reports and Presentations

The contractor shall assist NCCT lab personnel in preparing reports or presentations necessary to support the research being conducted. The work may include technical editing and report production tasks, like formatting, preparation of graphics, and publishing, sufficient to meet current EPA requirements. The contractor shall also provide support to EPA investigators in the preparation of journal articles, briefings, and other communications or outreach activities.

QUALITY ASSURANCE (QA)

The contractor shall follow the protocols, procedures and guidelines of the Office of Research and Development Quality Management Plan for Scientific Research as revised June 2012 (DCN: ORDQMP-01-01). Where applicable, calibration and operation of scientific instruments shall be performed under existing operating procedures in accordance with the Office of Research and Development Quality Management Plan for Scientific Research.

DELIVERABLES

Work Plan. A work plan containing a cost estimate shall be provided to the Contracting Officer (CO), PO and WA COR.

Task 1. Technical support for the NCCT Laboratory

The contractor shall provide support under this task as outlined in technical direction.

Task 2. Laboratory Stand-Up

The contractor shall provide support under this task as outlined in technical direction.

Task 3. Quality Assurance Laboratory Support

The contractor shall provide support under this task as outlined in technical direction.

Task 4. Instrumentation and Electronics

The contractor shall provide support under this task as outlined in technical direction.

Task 5. Development of Reports and Presentations

The contractor shall provide support under this task as outlined in technical direction.

SCHEDULE of DELIVERABLES

Work Plan: Within 20 days of receipt of the Work Assignment or as specified in the contract.

Task 1: As indicated in each Technical Directive issued.

Task 2: As indicated in each Technical Directive issued.

Task 3: As indicated in each Technical Directive issued.

Task 4: As indicated in each Technical Directive issued.

Task 5: As indicated in each Technical Directive issued.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 1-302

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2017

Base Option Period Number 1

Title of Work Assignment/SF Site Name

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW

Purpose:
- [X] Work Assignment
- [ ] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assignment Close-Out
- [ ] Incremental Funding

Period of Performance: From 04/01/2016 To 03/31/2017

Comments:

☐ Superfund — Accounting and Appropriations Data — [X] Non-Superfund

SFO (Max 2) ☐

Note: To report additional accounting and appropriations date use EPA Form 1900-69A.

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: 04/01/2015 To 03/31/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name David Murphy	(Signature)	(Date)	Branch/Mail Code:
			Phone Number:
			FAX Number:
Project Officer Name Robin S. Harris	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-0955
			FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code:
			Phone Number:
			FAX Number:
Contracting Official Name Mark Cranley	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-487-2351
			FAX Number: 513-487-2109

Performance Statement of Work

WA Title:	NCCT Application and Data Support	
WA #:	1-302	WACOR: David Murphy
Contract #:	EP-C-15-008	Alternate WACOR: Sandra Roberts

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from the time of award through March 31, 2017.

SUMMARY OF OBJECTIVES

The National Center for Computational Toxicology (NCCT) conducts research to identify, develop and implement alternative toxicity testing methods as part of the Agency's Chemical Safety and Sustainability (CSS) research program. The objective of this work assignment is to obtain contractor support to provide technical expertise to the NCCT Dashboard and Data Management teams. The contractors shall be instrumental in the development and on-going support of the Dashboards, including developing RESTful web services, detailed Application Programming Interfaces (APIs), user interfaces and integrated dashboard web sites in a modular architecture. Database management systems (DBMS) support will include continued development of DBMS configurations as well as Data Models supporting Dashboards and other NCCT scientific applications. The backend databases are primarily already in place or are being developed by other EPA staff or contractors. The overall systems architecture is also largely developed. The data management team requires contractor support in building an on-site MySQL database cluster, PostgreSQL databases and a MongoDB cluster to support all of NCCT scientific application development and research.

It is expected that the individuals proposed to fill these positions shall work full time schedules and be co-located on-site with NCCT developers. Contractor employees shall participate in an Agile software development environment and are expected to attend daily scrum meetings where development priorities shall be communicated.

BACKGROUND

NCCT requires contractor support to provide technical software development support to continue all software application development of comptox.epa.gov "Dashboards" and "Decision Support Tools" containing complex "workflows". In addition, NCCT requires on-going support for a variety of database management systems including, but not limited to, MySQL, PostgreSQL and MongoDB. Below, these custom built applications are generically called "Dashboards". Using these Dashboards, decision-makers will access summary information, as well as detailed information, derived from NCCT's DSSTox, ACToR, chemical exposure, hazard data, decision-rules and predictive models. The Dashboards will include information from diverse sources and will provide more integrated, holistic information for use in risk assessment and risk management decisions. The Dashboards will be customized based on the queries and complex filters from the decision maker using the web-based tools. The technology being used

combines backend MySQL and MongoDB databases, RESTful web services and frontend web applications developed primarily using Ruby, Java and JavaScript.

SCOPE

The primary purpose of this work assignment is to provide specialized software engineering and development as well as highly specialized data storage systems and data model support. This will includes, but is not limited to the development, maintenance and on-going expansion of the current CompTox web application (https://comptox.epa.gov) as well as other existing and future prototypes. Various database management systems supporting multiple storage engines will support many new and existing data models. The CompTox web application is a web-based, interactive suite of Dashboards. In the process of developing highly integrated modular Dashboards, as well as managing heterogeneous data, the contractors shall also provide expertise and support to NCCT staff to manage key software development tasks, most importantly the design, implementation and on-going maintenance of web services, APIs and frontend web applications. This will involve designing new databases supported by various data storage engines and working with existing databases in collaboration with NCCT staff and other contractors.

A comprehensive, but not all encompassing sampling of work to be conducted under this work assignment is:

1. Develop web services for specified databases and knowledgebases
2. Build wrappers around computational models so that they can have web services implemented
3. Include and support many existing Cheminformatics toolsets within web services and APIs
4. Develop web services for specified models
5. Develop new widgets/components as needed that can be integrated into the currently used frameworks and architectures
6. Develop specific modular dashboards as directed by EPA staff
7. Modify existing dashboards as needed
8. Document all applications. Documentation will be (1) in-line documentation in code at the level of individual functions and (2) documentation at the level of a SOP
9. Document web services so that external developers can use them
10. Create use documentation for dashboards (help pages)
11. Install and configure Database Management Systems on existing hardware
12. Design, implement and optimize data models utilizing new and existing databases

SPECIFIC TASKING AREAS

Task 1 – Data Management Systems Support

The contractor shall design, configure, implement and document a six node MySQL database cluster running MySQL Cluster CGE as described by the makers of said product. (Product description located: https://www.mysql.com/products/cluster/). The contractor shall support existing MySQL databases within the current Database Management System(s) and offer assistance to NCCT staff with regards to database optimizations, schema versioning, data versioning techniques and strategies and documentation. The contractor shall support NCCT's existing MongoDB NoSQL data stores and offer assistance with on-going development of data stores in a cluster environment across three existing nodes. (Hardware already procured by NCCT). The contractor may be required to purchase license renewals for data management systems.

Subtask 1.1 – MySQL Cluster CGE Implementation

The contractor shall install and configure MySQL Cluster CGE across six nodes already procured by NCCT. The cluster should be designed in collaboration with NCCT's staff to include high availability and high performance scenarios. The contractor shall consider heavy read intensive operations, in-memory databases, write intensive operations within the designed solution that are highly optimized and supports all NCCT's applications. On-going support and maintenance of the system(s) will be required.

Implementation strategies, techniques and details along with on-going maintenance requirements must be documented in NCCT's primary documentation tools known as Atlassian's Confluence which is owned and maintained by NCCT.

Subtask 1.2 – PostgreSQL DBMS Implementation

The contractor shall install and configure the latest open source version of PostgreSQL Database Management System to support all of NCCT's application development needs. The contractor shall work in collaboration with NCCT staff and on-site contractors to design PostgreSQL's configuration to support current and future NCCT Data management needs. The contractor shall consider heavy read intensive operations, in-memory databases, write intensive operations within the designed solution that are highly optimized and supports all NCCT's applications. Implementation strategies, techniques and details must be documented in NCCT's primary documentation tools known as Atlassian's Confluence which is owned and maintained by NCCT.

Subtask 1.3 – MongoDB NoSQL Implementation

The contractor shall install and configure the latest open source version of MongoDB document store to support NCCT's application development needs. The contractor shall work in collaboration with existing NCCT staff and on-site contractors to design MongoDB's configuration to support current and future NCCT Data management and software application needs. In addition, the contractor shall provide on-going maintenance requirements that are fully documented. Implementation strategies, techniques and details must be documented in NCCT's primary documentation tools known as Atlassian's Confluence which is owned and maintained by NCCT.

Subtask 1.4 – Data Model design and optimization

The contractor shall participate within application development teams and lead and/or assist in designing data models that are highly optimized for various use-cases that support NCCT applications. All data model designs must be documented in NCCT's primary documentation tools known as Atlassian's Confluence which is owned and maintained by NCCT.

Task 2 – Software Application Backend Development Support

The contractor shall provide support in delivering web-based dashboards that allow decision makers access to actionable information about chemicals in order to meet specific EPA Program Office (PO) needs. The dashboards consolidate information from disparate sources as collections of flexible, visual widgets, where individual widgets synthesize information according to user specifications. Widgets will then be combined into PO-specific dashboards, where PO partners can customize the information displayed to support diverse decision-making tasks. The use of such a customizable framework allows information from multiple sources to be recombined into comprehensive profiles according to programmatic needs.

Subtask 2.1 – Development of Web Services and APIs

The contractor shall develop a collection of web services and APIs in collaboration with existing NCCT staff and on-site contactors in order to support new and existing applications. Web services will be required to follow RESTful design principles and should be self-documenting. All development of web services and APIs should be developed in a modular architecture allowing highly integrated modules to be reused across many application implementations. Many web services and APIs will be required to broker communication between many disparate data sources as directed by NCCT staff. All web services and APIs should be designed to be self-discoverable and self-documenting. Details of the design and implementation techniques and strategies must be documented in NCCT's primary documentation tools known as Atlassian's Confluence which is owned and maintained by NCCT.

The primary implementation platform (already procured) consists of multiple application environments that spans across multiple Red Hat Enterprise Linux Servers. Currently, NCCT and others manage Development, Internal Staging, Internal Production, External Staging and External Production environments. Implementation of web services and APIs will include multiple frameworks and libraries as well as many tools. Contractor personnel must possess expertise in the following technologies:

1. Java 1.8
2. Java EE
3. Red Hat JBoss stack
4. Red Hat Developer Studio
5. Ruby 2.x
6. Rails 4.x
7. Git Version Control System
8. Other open source tools and technologies as advised by NCCT staff

Task 3 – Software Application Frontend Development Support

The contractor shall provide support in delivering web-based dashboards that allow decision makers access to actionable information about chemicals in order to meet specific EPA Program Office (PO) needs. The dashboards consolidate information from disparate sources as collections of flexible, visual widgets, where individual widgets synthesize information according to user specifications. Widgets will then be integrated into new and existing dashboards, where PO partners can customize the information displayed to support diverse decision-making tasks. The use of such a customizable framework allows information from multiple sources to be recombined into comprehensive profiles according to programmatic needs.

Subtask 3.1 – Development of Web Applications

The contractor shall design and develop dynamic database and web services driven web applications in collaboration with existing NCCT staff including, but not limited to, NCCT's Product Owners, Subject Matter Experts and Application Architect and well as existing on-site developers. Development support for existing applications is necessary as well as new Dashboard modules currently in the early design phases. The contractor shall assist in refactoring existing Applications and Prototypes into a collection of highly optimized modular, production quality, components that are able to be integrated into new and existing applications in a modular architecture.

Subtask 3.2 – Development of Frontend Web Components

The contractor shall develop a collection of isolated W3C standard Web Components in collaboration with NCCT's Application Architect. Development of said components must meet the requirements of NCCT's Product Owners and be able to integrate into web applications. Design and implementation of Web Components will utilize existing and new web services referenced to under subtask 2.1.

The contractor shall assist with on-going updates, development and maintenance of all NCCT web components. Details of the design and implementation techniques and strategies must be documented in NCCT's primary documentation tools known as Atlassian's Confluence which is owned and maintained by NCCT.

The primary platform and infrastructure will be the same as described in task 2.1 above. Implementation of web applications and components will include multiple frameworks and libraries as well as many tools. Contractor personnel must possess expertise in the following technologies:

1. Javascript ECMAScript 2015 (ES6)
2. React.js
3. Flux
4. Ruby on Rails 4.x
5. Git Version Control System
6. Other open source tools and technologies as advised by NCCT staff

QUALITY ASSURANCE

The Contractor shall confirm significant methodological and technical modifications with the WACOR throughout development, and document decisions related to software design and module functionality. The contractor shall develop a QAPP for this work assignment as described below.

QUALITY ASSURANCE PROJECT PLAN

EPA Guidance for Quality Assurance Project Plans for Modeling (QA/G-5M) (http://www.epa.gov/quality/qs-docs/g5m-final.pdf) will be used as necessary to ensure the essential QAPP components are addressed in the project-specific QAPP. The contractor shall develop a project-specific QAPP within 60 days of the approval of the work plan.

DELIVERABLES

Work Plan. A work plan containing a cost estimate shall be provided to the Contracting Officer (CO), PO and WA COR.

REQUIRED SERVICE	DELIVERABLES: Support will be ongoing under each of the following three tasks.
Task 1: Data Management Systems Support	MySQL Cluster CGE Install, configured and supporting NCCT Prototype and Production Applications.
Task 2: Application Backend Development Support	Specific web services and APIs will be designed, tested, documented and deployed in the EPA web service framework, with appropriate documentation in collaboration with NCCT Staff
Task 3: Develop complete dashboard applications and frontend widgets/components as needed	Combine appropriate tools and data sources (via web sources) to deliver complete dashboard solutions. Specific JavaScript widgets and W3C Standards Compliant Web Components will designed, tested, documented and deployed within NCCTs multiple software application environments, with appropriate documentation

Reporting Requirements/Deliverables:

The WACOR will provide periodic consultation and scientific oversight of the project.

- The contractor shall work as part of the Dashboard and Data Management teams and will be expected to attend daily and weekly on-site Agile Scrum project meetings as well as other project related meetings.

- At the start of a new project, the WACOR will meet with the contractor to provide general information and will assist in drafting a rough project plan outline and timeline for completion of individual tasks.
- WACOR may meet as frequently as daily with contractor(s) to review task progress, answer questions and provide technical clarification.

SCHEDULE of DELIVERABLES

Work Plan: Within 20 days of receipt of the Work Assignment or as specified in the contract.

QAPP: Within 60 days of work plan approval.

Task 1: As indicated in each Technical Directive issued. Deliverables for task 1 may include:

- Install and fully configure MySQL CGE across six (6) servers
- Migrate existing SQL databases into the new MySQL Cluster
- Install and fully configure PostgreSQL with a three (3) node cluster configuration providing failover and load-balancing
- Migrate existing PostgreSQL and MySQL databases into the PostgreSQL cluster as necessary
- Install and fully configure MongoDB with a three (3) node cluster configuration
- Migrate SQL to NoSQL data storage system in collaboration with NCCT staff
- Design, implement and document Cluster monitoring procedures including accessing detailed log files

Task 2: As indicated in each Technical Directive issued. Deliverables for task 2 may include:

- Implement and document ReSTful endpoints exposing NCCT Chemical data utilizing Red Hat JBoss and Java EE technologies as designed by NCCT staff
- Implement JSON Data Interchange Formatted responses to API and Web Service Calls as designed by NCCT staff
- Create Web Services for NCCT QSAR Data Models
- Integrate existing APIs and Web Services with new NCCT data

Task 3: As indicated in each Technical Directive issued. Deliverables for task 3 may include:

- Implement and document web-based Dashboard utilizing existing and new data
- Create W3C Standard Web Components for existing NCCT Dashboards functionality
- Implement modular component strategies utilizing React.js and Flux frameworks and libraries
- Integrate existing data as well as new data within newly designed components
- Migrate existing dashboard applications into React.js and Flux architecture