Performance Work Statement

WA Title: **Biocontaminant Laboratory Technical Support**

WA #: 2-61 WACOR: CALFEE

Contract #: EP-C-15-008 Alternate WACOR: WOOD

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

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.

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.

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.

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.

TECHNICAL APROACH/OBJECTIVES

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.

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

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.

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

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. No equipment or instrument purchases will be required for this WA.

QUALITY ASSURANCE

This WA provides analytical support to other DCMD WAs, each of which are conducted under an approved QAPP. The QAPP for these DCMD WA include the QA language, DQIs, and DQOs necessary to conduct the analytical procedures under this WA. As such, a QAPP specific for this WA is not required.

DELIVERABLES

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 monthly progress 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 month, 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 month, (5) hours and funds expended.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-064

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2018 Base Option Period Number 2	Aggressive Air Sampling

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 2A, 2B, 2E, 2F, 2G, 2H, 2J

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

Period of Performance: From 04/01/2017 To 03/31/2018

Comments:
Work plan due by 4/21/17

☐ 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 03/31/2018 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 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

WA Title: Optimization of Critical Parameters for Aggressive Air Sampling

WA #: 2-064 WACOR: Sang Don Lee

Contract #: EP-C-15-008 Alternate WACOR: Worth Calfee

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

SUMMARY OF OBJECTIVES

The goal of this work is to develop a sampling guideline using the aggressive air sampling (AAS) method characterized and enhanced through WA 0-64 and 1-64 for use in sampling Bacillus anthracis spores under various environmental conditions.

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.

SCOPE

The purpose of this project is to develop a sampling guideline using the AAS methods for sampling spores from various environmental conditions.

TECHNICAL APROACH/OBJECTIVES

Literature review: literature search will be conducted to collect the previous AAS research results for spore sampling and asbestos site sampling for technical and operational information and lessons learned. The literature review will identify the optimal site environment to apply AAS for spore sampling. Missing information from this literature review will be obtained via laboratory tests. The laboratory tests will not exceed 30 tests with the chamber developed in the WA 1-64.

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 an indoor environment. 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. 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 developing a QAPP.

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 revise the existing QAPP as necessary to account for doing the experiments on spore deposition and material preparation for laboratory tests.

Task 2. Literature Review

The contractor shall identify, collect, evaluate, and summarize available articles, case studies, reports, guidance documents, and other pertinent information related to Aggressive Air Sampling within the United States. The contractor shall present EPA with the search criteria prior to embarking on the literature search. The Contractor shall identify the optimal site environment to apply AAS for spore

sampling and missing technical/operational information to develop a sampling guideline.

Task 3. Laboratory Experimentation

In Task 3, the contractor shall conduct experiments to obtain the technical/operational information of AAS to develop a sampling guideline. All tests shall be conducted using the same test chamber in the QAPP, Identification of critical parameters for aggressive air sampling. The test conditions will be determined by the Task 2 and EPA WACOR will assist the Contractor to determine the priority of test conditions. 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 4. Report Preparation

In Task 4, the contractor shall prepare a full report detailing the literature review, test procedure/results and sampling guideline. The report shall be compatible with the EPA publication requirements. 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.

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

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.

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. QAPP and Work Plan: 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.

5. Reports: The Contractor shall prepare a draft report including measurement and Quality Control data of all tests. The draft 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. A Draft Report shall be provided to EPA for review by March 1, 2018. A final report shall be provided 10 business days after EPA comments.

SCHEDULE of DELIVERABLES

Task Progress and Cost Reports	Monthly
QAPP Revisions	Within 30 days of WA initiation
Health and Safety Research Protocols	Within 30 days of WA initiation
Draft Report	March 1st 2018

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	IAG	Interagency Agreement
NHSRC	National Homeland Security Research Center	QA	Quality Assurance
QA ID	Quality Assurance Identification	QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan	QMP	Quality Management Plan
QS	Quality System	SOW	Statement of Work
PI	Principal Investigator	CRADA	Cooperative Research & Development Agreement

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-066

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number: 2

Title of Work Assignment/SF Site Name: Vacuum-based Biological Agent

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 2A, 2B, 2E, 2F, 2G, 2H, 2J

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

Period of Performance: From 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17

☐ 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 03/31/2018 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: 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

WA Title: Development of a Vacuum-based Biological Agent All Surface Sampler

WA #: 2-066 WACOR: Sang Don Lee

Contract #: EP-C-15-008 Alternate WACOR: Worth Calfee

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

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 collecting 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.

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.

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 procedures. Commercially available devices including wet vacuum and robotic floor cleaners or laboratory developed and modified sampling devices will be evaluated for collection efficiency through a set of controlled tests and large scale pilot tests (e.g. a single house). 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.

TECHNICAL APROACH/OBJECTIVES

A known quantity of Bacillus spores will be deposited by aerial dispersion onto large floor surface coupons (1 ft2 or greater) that can be commonly found in an indoor and outdoor environment. The coupons will then be sampled using commercially available wet vacuums, robotic floor cleaners, and laboratory developed devices. 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.

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 revise the existing QAPP as necessary to account for doing the experiments on spore deposition and material preparation for laboratory tests.

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 and 1-66. 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 and liquid deposited Bacillus spores including thuringiensis and atrophaeus between the commercial products (commercial wet vacuums, robotic floor cleaners, and laboratory modified devices) 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 102 to 107 CFUs per ft2. The contractor shall take digital photos and videos of test procedures.

Task 3. Large Pilot Scale Tests

The Contractor shall conduct large pilot scale tests to evaluate the sampling procedures in various contamination scenarios. The scenarios shall be at least 10 but less than 20 in a mock house setting. The pilot test locations, including but not limited to office, bedroom, 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 Contractor shall identify the potential steps that may cause difficulties of operation and cross contamination and revise the existing sampling procedures. The sampling procedure will be revised based on the outcomes from each test. Following each revision of the procedure, the pilot test shall be repeated. For these pilot tests, 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. Sampling Exercise Support

The contractor shall provide technical support, operating experience, analytical support, and expendable materials to conduct EPA sampling exercises using a mock house. This support shall include:

- Provide expendable materials and building supplies to modify, operate, and maintain the sampling exercise location, as appropriate.
- Provide engineering and operating labor for the design and execution of sampling exercises including surrogate preparation, sample analysis, deposition, decontamination, and waste management.
- Maintain sampling devices appropriately according to manufacturer manuals.

Task 5. 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.

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

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 WACOR. The sampling activities shall be conducted in the NERL's Fluid Modeling Facility, NRMRL's test house, and/or 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.

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. QAPP and Work Plan: 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.

5. Data Reports: The Contractor shall prepare a draft report including measurement and Quality Control data of all tests. The draft 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. A Draft Report shall be provided

to EPA for review by March 1, 2018. A final report shall be provided 10 business days after EPA comments.

SCHEDULE of DELIVERABLES

Task Progress and Cost Reports	Monthly
QAPP Revisions	Within 30 days of WA initiation
Health and Safety Research Protocols	Within 30 days of WA initiation
Data Draft Report	March 1st 2018

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-067

☐ Other ☐ Amendment Number:

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 2	Table of forces for Human Acti

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 2.01,j

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

Period of Performance: From 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17.

☐ 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 03/31/2018 — 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 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

WA Title: Developing Table of Forces for Human Activity as it Relates to Reaerosolization and Exposure to *Bacillus anthracis* Spores from Outdoor Urban Surfaces

WA #: 2-067 WACOR: John Archer

Contract #: EP-C-15-008 Alternate WACOR: Russell Wiener

NOTE: This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment #1-067. It is anticipated that the Quality Assurance Project Plan (QAPP), test plan, and Health and Safety Plan (HASP) will be submitted during Option Period 1 and that the experiments and report writing will conclude during Option Period 2.

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

SUMMARY OF OBJECTIVES

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).

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.

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 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 U.S. Environmental Protection Agency (EPA)/National Homeland Security Research Center (NHSRC) will support this PWS.

SCOPE

The goal of this work is to evaluate human activity and associated forces and their thresholds to initiate reaerosolization of spores from outdoor surfaces. There are gaps in understanding the influences of human activities as it related to reaerosolization. The purpose of this Work Assignment (WA) is to conduct research to fill some of the key knowledge gaps in this area. This work assignment will support the goals of the Scientific Program on Reaerosolization and Exposure (SPORE) Program.

TECHNICAL APROACH/OBJECTIVES

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 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.

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

This effort is labor intensive, which is where the bulk of the funding is required. Some equipment may need to be purchased under this WA. The contractor shall procure all test materials/equipment necessary for the work. Instrumentation for analysis is already onsite at EPA. The work is expected to be conducted at EPA's Research Triangle Park Facility.

QUALITY ASSURANCE

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 which will be approved by the EPA NHSRC QA Manager. 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.

TASKS

A series of reports have been 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.

The following tasks are defined as part of this work assignment:

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.

Task 2: Experimental design of controlled test:

The Contractor shall use barcoded Btk as the surrogate for Ba reaerosolization utilizing the methodology developed 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.

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.

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.

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, quarterly and cumulative financial expenditures and cost and schedule variance.

- A draft report shall be delivered to the EPA WACOR by 5/15/17.

SCHEDULE of DELIVERABLES

Table 4: Deliverable Schedule

Deliverable	Date
QAPP/Test Plan	To be submitted during Option Period 1

Data summaries	On-going
Draft Report	5/15/2017
Final Report	2 weeks after receiving review comments

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 may be authored or co-authored by the EPA 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 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.

Attachment A 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
IAG	Interagency Agreement
NHSRC	National Homeland Security Research Center
PI	Principal Investigator
QA	Quality Assurance
QA ID	Quality Assurance Identification
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QMP	Quality Management Plan
QS	Quality System
SOW	Statement of Work
CRADA	Cooperative Research & Development Agreement

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-067

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2017 To 03/31/2018

Base Option Period Number 2

Title of Work Assignment/SF Site Name: Developing Table

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 04/01/2017 To 03/31/2018

Comments:
This amendment is to add Sangdon Lee as the Alternate WACOR. All other terms and conditions remain unchanged.

☐ 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 John Archer
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-1151
FAX Number:

Project Officer Name Melissa Revely-Wilson
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0207
FAX Number:

Other Agency Official Name Keith Pfeffer
(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:

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-068

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number: 2

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 04/01/2017 To 03/31/2018

Comments:
Work plan due by 4/21/17

☐ 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 03/31/2018 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: Paul Lemieux
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0962
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

This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment # 1-068

WA Title: Thermal Treatment of CBR Contaminants (HS 8.64.04-0420)

WA #: 2-068 **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, 2018.

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

Elemental analyses of the sorbent and pellet material shall be performed using the EPA's 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 and/or rotary kiln incinerator simulator, 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 modifications to the rotary kiln's feeding apparatus for ground tires to be suitable for biomass pellets.

WA SPECIFIC EQUIPMENT

- Rotary Kiln Incinerator Simulator
- 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: 2-069

☐ Other ☐ Amendment Number:

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 2	Remediation of Radioactively C

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 04/01/2017 To 03/31/2018

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										
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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 Paul Lemieux (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-0962 FAX Number:
Project Officer Name Melissa Revely-Wilson (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-0207 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 EP-C-15-008

PROJECT: HS 8.63.02
WORK ASSIGNMENT: 2-069

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 Performance Work Statement (PWS) shall be from award to March 31, 2018.

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: 2-072

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2018 Base Option Period Number 2	Water impact on decontamation

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 2.0

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

Period of Performance: From 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17.

☐ 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 03/31/2018 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 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

Performance Statement of Work

WA Title: Impact of surface dirt & grime on use of bleach for bio decon

WA #: 2-072 WACOR: Lukas Oudejans

Contract #: EP-C-15-008 Alternate WACOR: Worth Calfee

NHSRC Project Number: HS8.63.02-0123

NOTE: *This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment # 1-072.*

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from April 1, 2017 through March 31, 2018.

1. SUMMARY OF OBJECTIVES

This continuation of WA 1-072 will wrap up the evaluation of the impact of dirt and grime as present on subway related 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 WA will focus on (exterior) subway car materials.

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. This WA will complete the intended tests that were not completed under WA 1-072 due to, among others, a technical flaw in the decontamination approach for smaller coupons.

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 contracting officer representative (WACOR).

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.

A QAPP entitled "Impact of Surface Dirt and Grime on Use of Bleach for Biodecontamination" was approved on 5/24/2016. Hence, Task 1 applies only to amendments to this QAPP, as needed.

The contractor shall continue to use the same subway surface sample preparations, surface sampling approaches, and inoculation methods as started under WA 1-072. The focus for this WA is on the exterior subway rolling stock materials.

Task 1: Preparation of Quality Assurance Project Plan (QAPP) Amendments

The contractor shall prepare amendments to the approved QAPP in accordance with Quality Assurance (QA) **Category B.**

QAPP amendments 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 prior to the start of any literature searches (existing data), data collection, gathering, synthesizing, or data generation (laboratory) work.

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

Task 2. DECONTAMINATION TESTS

The contractor shall expect to conduct sprayed pH amended bleach decontamination experiments using up to three subway car related materials. For these materials, grimed coupons and clean coupons shall be included in the test matrix.

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 WACOR during the writing of the QAPP amendment.

Task 3. TEST REPORTS

The contractor shall generate two reports, namely (1) a data summary report for the decontamination tests related to the decontamination of the ballast and (2) a full EPA report of all decontamination research under WAs 1-072 and 2-072, including the ballast decontamination results. Only one version of the data summary report shall be generated. For the full EPA report, the contractor shall create a draft version (Draft I) detailing a summary of findings, test conditions, methods, quality assurance, test results, and lessons learned from the testing completed under WA 1-072 and Tasks 2 of this PWS. 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 WACOR and EPA product team.

A second version (Draft II) of the EPA report that incorporates the requested changes, corrections, and clarifications shall be submitted by the contractor following receipt of the combined comments from the EPA WACOR and EPA product team. This draft report (Draft II) will be submitted by the EPA WACOR 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 WACOR by the contractor together 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 entitled "Impact of Surface Dirt and Grime on Use of Bleach for Biodecontamination" was approved by EPA on 5/24/2016.

6. DELIVERABLES

1. The contractor shall transmit all data from Tasks 2. 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 3 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*
Data summary spreadsheets for Tasks 2	Within 2 weeks of completion of the test matrix
Data summary report for ballast decontamination	8 weeks after award
Draft I Test Report – Task 3	26 weeks after award
Draft II Test Report – Task 3	2 weeks after receipt EPA WACOR and product team comments
Final Report	2 weeks after EPA QA and peer review comments

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-073

☐ Other ☐ Amendment Number:

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 2	Wet-vacuum sampling

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 2.0

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

Period of Performance: From 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17

☐ 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										
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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 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 Statement of Work

WA Title: Wet-vacuum sampling of soluble chemical agents on building surfaces

WA #: 2-073 WACOR: Lukas Oudejans

Contract #: EP-C-15-008 Alternate WACOR: Sang Don Lee

NHSRC Project Number: HS7.52.01-0199

NOTE: ***This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment # 1-073.***

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

1. SUMMARY OF OBJECTIVES

This work will develop standard test methods for a wet vacuum approach for sampling of surface areas contaminated with toxic chemicals and/or chemical warfare agent (CWA) surrogates. The focus will shift from hand held wet vacuum cleaners to floor wet vacuum systems.

2. BACKGROUND

In the event of a chemical incident, samples must be collected, preserved, and analyzed to assess the size of the contaminated area and, following decontamination efforts, to determine whether cleanup goals have been accomplished. Surface sampling is typically conducted using wipes with a relatively small sampling area. Incorporation of statistical sampling theory results fairly quickly in a large number of samples that would be required to support confident decision making. With a known limited capacity to analyze chemical samples, especially for chemical warfare agents, such sampling approach may become difficult to implement as part of the remediation and clearance process. Aside from revising sampling strategies, sampling larger areas is an alternative approach to reduce the number of samples. Avoiding the wipe extraction step by sampling using a solvent that can be directly analyzed (e.g., by gas chromatography/mass spectrometry [GC/MS]) would also reduce the burden on an analytical laboratory.

Under the previous work assignment (1-073), a commercially available hand held wet vacuum system was evaluated on its ability to sample various indoor surfaces for the presence of chemicals with a different degree of solubility in water. Based on the initially poor recovery of

IPA due to evaporation in the cleaner system, the chemicals were sampled from the surface using water which led to lower recoveries than envisioned. Subsequent research resulted in a modified approach in which the wet vacuum cleaner is pre-wetted using IPA as to improve on the recovered IPA volume. A post sampling rinse was added to further improve on the recovered amount of the targeted chemicals. The work described in this PWS builds on this work and its associated method development and will assess the use of a floor wet vacuum system to sample larger (>4 ft^2) floor areas. It will also compare the wet vacuum results against traditional sampling methods that are currently be used.

3. SCOPE

This study will determine whether a floor wet vacuum system can be used to sample large areas (10-100 ft^2) that are contaminated with chemicals with different solubility. Any preparation steps such as a pre wetting volume or post sampling rinse will be investigated and documented as part of a to be developed standard operation procedure (SOP).

4. TECHNICAL APROACH/OBJECTIVES

The contractor shall consider the previously determined sampling liquid (isopropanol), liquid amount and sampling procedure for a handheld wet vacuum cleaner/sampler and make modifications when using a floor wet vacuum system. A commercially available floor cleaning device will be evaluated for collection efficiency through a set of controlled tests. Up to five (5) chemicals, including three chemicals previously tested (phenol, triethylphosphate [TEP], methylphosphonic acid [MPA]) with low volatility and various degrees of solubility (in water) will be selected by the EPA WACOR and EPA Product Team. The contractor shall expect that one of the remaining chemicals will be a solid state /powder. These chemicals shall be deposited onto up to two different types of hard, nonporous, surface areas up to 100 ft^2 in size. The area will then be subjected to vacuum-based sampling, using a wet vacuum device of interest. The contractor shall also conduct conventional sampling of the same surface area for presence of the targeted chemical.

Recovery will be determined for each sampling device by analysis of the extract. All other test parameters, such as sampling approaches and methods of extraction / analysis will be established following discussion with the EPA WACOR and EPA project team. Chemical analysis of the samples shall be conducted by an accredited chemical analysis laboratory. The contractor shall be responsible for all communications with the subcontractor, including Quality Assurance and Quality Control of analysis and results. The contractor shall ship extraction samples as created under these Tasks to the subcontracted chemical analysis laboratory.

The contractor shall provide the personnel, equipment, materials, and supplies necessary to perform the following Work Assignment tasks:

Task 1: Preparation of the Quality Assurance Project Plan (QAPP)

Change A2 to the QAPP entitled "Decontamination Solution Methods for Toxic Industrial Chemicals: Assessment of Decontamination Application and Sampling Method" was approved by EPA on November 16, 2016.

Should amendments to the QAPP be required, the contractor shall prepare amendments to the QAPP in accordance with Quality Assurance (QA) **Category B.** Attachment 1 to this Performance Work Statement (PWS) provides information regarding NHSRC QA Requirements/Definitions List. An amendment to the QAPP must be approved prior to the start of any data collection described in such amendment. Additional information related to QA requirements can be found at www.epa.gov/quality.

Task 2: Modifications to floor wet vacuum cleaner/sampler

The contractor shall consider making modifications to the existing wet vacuum unit or its application procedures in communications with the EPA WACOR and EPA project members as to allow for sampling of an organic solvent such as isopropanol. The contractor shall expect to demonstrate these modifications through measurement of recovered solvent amount from two nonporous surfaces of representative size.

Task 3: Evaluation of modified wet vacuum system

The contractor shall determine the overall effectiveness of the commercial device as a function of the material type. The contractor shall create a test matrix for the evaluation of the (modified) floor wet vacuum sampling system which shall include two flooring materials against up to five chemicals. This test matrix shall also consider two concentration levels with the initial concentration at previously evaluated and a second concentration at (nominal) 1% of the initial concentration. Three (3) replicate test areas and one procedural blank area of each material type shall be included in each test - a total of four (4) areas for each chemical-surface combination. There shall also be associated lab blank (LB) samples.

Task 4: Conventional sampling

The contractor shall conduct conventional sampling of the targeted chemicals according to methods described in e.g. the NHSRC Selective Analytical Methods (SAM) document and accompanied sampling guidance documents. Each area, including the procedural blank area, shall be sampled at five (5) locations using individual sample areas of size as recommended by existing sampling method documents.

Task 5: Test Report

Following completion of all data collection, the contractor shall prepare a draft version of a full evaluation report (Draft I) detailing a summary of findings, test conditions, methods, quality assurance, test results, and lessons learned from the testing under previous WA 1-073, and Tasks 2-4. 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 WACOR 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 WACOR and EPA product team. This draft report (Draft II) will be submitted by the EPA WACOR 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 WACOR 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

QAPP amendments must be approved prior to the start of any environmental data collection identified in such amendment. Additional information related to the QA requirements can be found at http://www.epa.gov/quality.

6. DELIVERABLES

1. The contractor shall have biweekly meetings with the EPA WACOR to discuss any technical difficulties and report progress as part of the regular DTRL meeting.
2. The contractor shall have additional meetings with the EPA project team to discuss in details of the study as needed.
3. The contractor shall create amendments to the existing QAPP, if needed, as per Task 1
4. The contractor shall transmit all data related to Task 2 method development and/or demonstrations prior to continuation with Tasks 3 and 4.
5. The contractor shall transmit all data from Tasks 2-4 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.

7. SCHEDULE of DELIVERABLES

Deliverable Schedule.

ID	*Deliverable*	*Schedule*
1	Data summary spreadsheets for Tasks 2-4	11/15/2017
2	Draft I Test Report – Task 5	Due 30 days after Deliverable 1
3	Draft II Test Report – Task 5	Due 14 days after receipt of EPA WACOR and EPA product team comments
4	Final Report – Task 5	Due 14 days after receipt of QA and peer review comments

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-074

☐ Other ☐ Amendment Number:

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 2	Decontamination of Surfaces

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 2.0

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

Period of Performance: From 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17

☐ 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 03/31/2018 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 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

Performance Statement of Work

WA Title: Assessment of Decontamination Solution Application Methods for Decontamination of Surfaces Contaminated with Pesticides

WA #: 2-074 WACOR: Lukas Oudejans

Contract #: EP-C-15-008 Alternate WACOR: Paul Lemieux

NHSRC Project Number: HS8.63.02-0434

NOTE: *This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment # 1-074.*

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from April 1, 2017 through March 31, 2018.

1. SUMMARY OF OBJECTIVES

This work assignment will interpret the data collected during the previous WA 1-074 in which decontamination solution application methods were evaluated that are being used in the field in response to e.g., the misuse or overuse of pesticides associated with the bed bug epidemic. This was accomplished through measurement of decontamination efficacies of known efficacious decontaminants using various techniques (spray, soak, wipe, brush, etc.) on medium size surfaces. Results from this study will inform remediation specialists in the field on the best approach in cleanup of pesticides in indoor environments.

2. BACKGROUND

There has been an increase in pesticide misuse incidents for controlling bed bugs and other insects in indoor environments. These incidents include pesticide products not registered by the US EPA for indoor use or approved pesticide products that are improperly applied or at concentrations that exceed the labeled rates. The bed bug epidemic is expected to result in a growing number of incidents. 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. Currently, there are no tools to adequately evaluate 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 to decontaminate them creating more toxic byproducts or further dispersing contamination. Pesticide manufacturers and the Office of Pesticide Programs offer virtually no assistance when these products are applied illegally or in unintended ways.

The goals of this project are to provide responding agencies with information to evaluate the effectiveness of cleaning approaches. This effort will build on previous efforts under EPA's Homeland

Security Research Program (HSRP) that determined conditions that led to effective cleanup of building materials.

3. SCOPE

Here, the focus will be on the best approaches to decontaminate contaminated surfaces. This study will determine whether expected decontamination efficacy can be impacted by the approach to deliver the decontaminant.

4. TECHNICAL APROACH/OBJECTIVES

Under previous WA 1-074, the contractor conducted research in which decontamination efficacies were determined for liquid decontaminants applied to medium sized material coupons. For each test, the effort included the measurement of the recovery of residual pesticide amounts from stainless steel and compared to the amount extracted from a non-decontaminated coupon to measure the efficacy of the decontaminant and application approach. This WA describes the need to process and interpret the obtained data and create a test report.

There is no quality assurance related task/requirement as the contractor has completed the research covered under QAPP entitled "Assessment of Decontamination Solution Application Methods for Decontamination of Surfaces Contaminated with Pesticides" as approved on 10/24/2016.

Task 1 Test Report

The contractor shall prepare a full evaluation report (a draft version for EPA WACOR and EPA project team review followed by a revised draft for EPA peer and QA review; and a final version) which shall include a summary of findings, test conditions, methods, quality assurance, and results of the tests conducted per the requirements of this SOW. 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

The QAPP (amendments) 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 create a first draft report. Upon receipt of comments from the EPA WACOR, the contractor shall provide a revised draft version.
2. The contractor shall provide a final version that incorporates the EPA peer and QA review comments.
3. 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.

4. SCHEDULE of DELIVERABLES

Deliverable	*Schedule*
First Draft Test Report	5 weeks after award
Second Draft Test Report for EPA QA/Peer Review	1 week after receipt of EPA comments
Final Test Report	2 weeks after receipt of EPA QA and peer review comments

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-074

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018
Base Option Period Number 2

Title of Work Assignment/SF Site Name: Decon sol app pestic

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 04/01/2017 To 03/31/2018

Comments:
NEW Task 1_A1 Extended Data interpretation. All other terms and conditions remain unchanged.

☐ 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: Lukas Oudejans
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-2973
FAX Number:

Project Officer Name: Melissa Revely-Wilson
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0207
FAX Number:

Other Agency Official Name: Keith Pfeffer
(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:

Amendment 1 to

Performance Statement of Work

WA Title: Assessment of Decontamination Solution Application Methods for Decontamination of Surfaces Contaminated with Pesticides

WA #: 2-074 WACOR: Lukas Oudejans

Contract #: EP-C-15-008 Alternate WACOR: Paul Lemieux

NHSRC Project Number: HS8.63.02-0434

NOTE: *This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment # 1-074.*

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from April 1, 2017 through March 31, 2018.

1. SUMMARY OF OBJECTIVES

No changes.

2. BACKGROUND

No changes.

3. SCOPE

No changes.

4. TECHNICAL APROACH/OBJECTIVES

Under previous WA 1-074, the contractor conducted research in which decontamination efficacies were determined for liquid decontaminants applied to medium sized material coupons. For each test, the effort included the measurement of the recovery of residual pesticide amounts from stainless steel and compared to the amount extracted from a non-decontaminated coupon to measure the efficacy of the decontaminant and application approach. This WA describes the need to process and interpret the obtained data and create a test report.

Task 1 Test Report

No changes.

NEW Task 1_A1 Extended Data interpretation

As part of the report writing under Task 1 (Test report writing), the contractor shall provide an in depth assessment of the research data. Such assessment shall consider appropriate statistical interpretations of the experimental results. Outputs from these statistical analyses shall be incorporated in the test report (deliverable for Task 1).

5. QUALITY ASSURANCE

No changes.

6. DELIVERABLES

No changes.

SCHEDULE of DELIVERABLES

Updated with this amendment

Deliverable	***Schedule***
First Draft Test Report	3 weeks after receipt of analytical results from subcontracting laboratory
Second Draft Test Report for EPA QA/Peer Review	1 week after receipt of EPA comments
Final Test Report	2 weeks after receipt of EPA QA and peer review comments

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-077

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number 2

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 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17

☐ 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 03/31/2018 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 Shannon Serre	(Signature)	(Date)	Branch/Mail Code:
		Phone Number: 919-541-3817
		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

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.

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

PERFORMANCE WORK STATEMENT

Note: This work assignment is a follow-on to work performed in option period 1 under Work assignment # 1-077.

WA Title: The Impact of Fogging on Materials and Equipment

WA #: 2-77 WACOR: Shannon Serre

Contract #: : EP-C-15-008 Alternate WACOR: Joe Wood

PERIOD OF PERFORMANCE
The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

SUMMARY OF OBJECTIVES

This work shall determine the impact of fogging with liquid sporicides on building materials and electronic equipment.

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.

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.

TECHNICAL APPROACH/OBJECTIVES

All test equipment and materials to be included in the test sets were 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 WACOR 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.

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

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.

QUALITY ASSURANCE

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: A QAPP for this project has already been prepared and approved.

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.

DELIVERABLES

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 following tasks are defined as part of this work assignment:

Task 1 – Preparation of Work Assignment Work Plan
A detailed Work Plan shall be submittied. 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 via technical direction. Additionally, a standard set of coupons to be fogged with the computers shall be provided to the contractor by the WACOR. 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	McMaster Carr	3350K19	2" x 2", 3 pieces

Material	Description	Supplier/ Manufacturer	Part Number	Coupon/ Sample Size
	grade, 99.99% pure			
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
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

Material	Description	Supplier/ Manufacturer	Part Number	Coupon/ Sample Size
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 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 will be provided by the WACOR. 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 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 WACOR 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.

SCHEDULE of 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, quarterly and cumulative financial expenditures and cost and schedule variance.

Table 4: Deliverable Schedule

Deliverable	Date
Data Summaries	On-going
Draft Report	30 days before end of WA

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 WACOR. The papers may be authored or co-authored by the EPA. 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 WA (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 # 1

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: 2-078

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number: 2

Title of Work Assignment/SF Site Name: Water rises impact on deconta

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 2.0

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

Period of Performance: From 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17

☐ 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 03/31/2018 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: 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

Performance Statement of Work

WA Title: Water rinses and its impact on decontamination efficacies

WA #: 2-078 WACOR: Lukas Oudejans

Contract #: EP-C-15-008 Alternate WACOR: Matthew Magnuson

NHSRC Project Number: HS8.63.03-0106

NOTE: ***This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment # 1-078.***

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, 2018.

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 wrap up the measurement of 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. Under previous WA 1-078, all research was completed except for the extractions analyses by an external analytical laboratory. This WA continuation aims to conclude this study through data interpretation and report writing.

TECHNICAL APROACH/OBJECTIVES

Under previous WA 1-078, the contractor conducted research in which the impact of water rinses on overall efficacy was determined. This WA describes the need to process and interpret the obtained data and create a test report.

There is no quality assurance related task/requirement as the contractor has completed the research covered under QAPP entitled "Water Rinses and Their Impact on Decontamination Efficacies" as approved on 11/07/2016.

Task 1: Data processing, interpretation and test report writing

Upon receipt of the analytical data, the contractor shall interpret the data and prepare a full evaluation report (a draft version for EPA WAM and EPA project team review followed by a revised draft for EPA peer and QA review; and a final version) which shall include a summary of findings, test conditions, methods, quality assurance, and results of the tests conducted per the requirements of this SOW. 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.

WA SPECIFIC EQUIPMENT

No specific equipment has been identified for acquisition by the contractor

QUALITY ASSURANCE

An approved QAPP exists for this study.

DELIVERABLES

1. The contractor shall create a first draft report. Upon receipt of comments from the EPA WACOR and project team, the contractor shall provide a revised draft version.

2. The contractor shall provide a final version that incorporates the EPA peer and QA review comments.

3. 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.

SCHEDULE of DELIVERABLES

Deliverable	***Schedule***
First Draft Test Report	5 weeks after receipt of analytical results but no later than 10 weeks after award
Second Draft Test Report for EPA QA/Peer Review	1 week after receipt of EPA WACOR and project team comments
Final Test Report	2 weeks after receipt of EPA QA and peer review comments

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-080

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2018 Base Option Period Number 2	Decontamination Solution Appli

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 2.0

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

Period of Performance: From 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17

☐ 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 03/31/2018 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 Joe Wood (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-5029 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

WA Title: Feasibility Study for Capture of Methyl Bromide
WA 2-080
WACOR Joseph Wood
Alt WACOR Shannon Serre
CONTRACT EP-C-15-08

PERIOD OF PERFORMANCE

The period of performance for this work assignment (WA 080) shall be from April 1, 2017 to March 31, 2018.

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. The primary purpose is to determine how many cycles the carbon can be reactivated with heated air and continue to effectively adsorb the MeBr.

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.

SCOPE

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 methyl bromide from simulated fumigation air streams.

TECHNICAL APPROACH/OBJECTIVES

This WA is a continuation of a similar previous WA 1-080. A QAPP has already been developed.

The Contractor shall perform the following tasks:

1. 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.

8. 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.

ISTRUMENTATION/EQUIPMENT EXPECTATIONS

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.

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

DELIVERABLES

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.

SCHEDULE OF DELIVERABLES

Suggested Deliverable Schedule

Deliverable	**Completion Date**
Submit work assignment plan	4/15/17
Complete Task 1 experiments	9/1/17
Complete data analysis per Task 4	10/1/17
Complete other tasks	ongoing
Submit draft test report (Task 8)	11/1/17
Submit final report (Task 8)	12/1/17

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-080

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number 2

Title of Work Assignment/SF Site Name: Feasibility Study for Capture

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 04/01/2017 To 03/31/2018

Comments:
See attached Amendment 000001 PWS for highlighted changes. All other terms and conditions remain unchanged.

☐ 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 Joe Wood
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-5029
FAX Number: 919-541-0496

Project Officer Name Melissa Revely-Wilson
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0207
FAX Number:

Other Agency Official Name Keith Pfeffer
(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

Amendment 000001

WA Title: Feasibility Study for Capture of Methyl Bromide
WA 2-080
WACOR Joseph Wood
Alt WACOR Shannon Serre
CONTRACT EP-C-15-008

PERIOD OF PERFORMANCE
The period of performance for this work assignment (WA 080) shall be from April 1, 2017 to March 31, 2018.

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. The primary purpose is to determine how many cycles the carbon can be reactivated with heated air and continue to effectively adsorb the MeBr.

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.

SCOPE
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 methyl bromide from simulated fumigation air streams.

TECHNICAL APPROACH/OBJECTIVES
This WA is a continuation of a similar previous WA 1-080. A QAPP has already been developed.

The Contractor shall perform the following tasks:

1. Conduct three sets of 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. Each set of experiments shall be conducted at a certain adsorption or desorption condition, include three replicate samples of carbon, with each sample subject to five adsorption/desorption cycles. The third set of experiments shall be conducted using

humidified air (e.g., 75% relative humidity [RH]) for the adsorption phase and ambient RH for the desorption phase.

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 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.

ISTRUMENTATION/EQUIPMENT EXPECTATIONS

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.

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

DELIVERABLES

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, 2017. 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.

SCHEDULE OF DELIVERABLES

Suggested Deliverable Schedule

Deliverable	**Completion Date**
Submit work assignment plan	4/15/17
Complete Task 1 experiments	12/1/17
Complete data analysis per Task 4	1/15/18
Complete other tasks	ongoing
Submit draft test report (Task 8)	2/1/18
Submit final report (Task 8)	3/1/18

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-082

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number: 2

Title of Work Assignment/SF Site Name: Continued Use of water treatme

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 2.0.1.J

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

Period of Performance: From 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17

☐ 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 03/31/2018 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: Russell Wiener
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-1910
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

WA Title: Continued Use of water treatments to inhibit resuspension of anthrax spores

WA #: 2-082 WACOR: Russell Wiener

Contract #: EP-C-15-008 Alternate WACOR: John Archer

NOTE: This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment #1-082. The Quality Assurance Project Plan (QAPP), test plan, and Health and Safety Plan (HASP) have been submitted during Option Period 1 or in the base period and that the experiments and report writing will continue during Option Period 2. One task from Option 1 was concluded and deleted, no new tasks were added.

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

SUMMARY OF OBJECTIVES:

This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment # 1-082. 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.

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 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

SCOPE

A series of reports have been 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 WACOR 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 WACOR, 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.

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 categories

TECHNICAL APROACH/OBJECTIVES

Task 1: 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 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 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, 2017.

Task 2: 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 prior experiments conducted for EPA shall be tested. The specific coupon types selected will be based on the results of the 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, 2018.

Task 3: 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, 2018.

Task 4: Statistical Analysis and Technical Editing:

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, 2018.

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.

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

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. The contractor shall prepare instruments for use by EPA personnel and provide training in proper operation of said instruments when required by the WACOR.

Date of completion March 31, 2018.

QUALITY ASSURANCE

(A) 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.

(B) 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.

DELIVERABLES

Work Plan. A work plan containing a cost estimate shall be provided to the Contracting Officer (CO), PO and WACOR within 21 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 provided to the WACOR on or before March 31, 2018.

SCHEDULE of *DELIVERABLES*

Need	Meeting Purpose	Frequency
X	to discuss workplan	Once
X	to review data or analyses	Weekly
X	to review monthly cost report	Monthly

- www.epa.gov/nhsrc under the policy and guidance tab.

Attachment A 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.

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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

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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
IAG	Interagency Agreement
NHSRC	National Homeland Security Research Center
PI	Principal Investigator
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QA ID	Quality Assurance Identification
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QMP	Quality Management Plan
QS	Quality System
SOW	Statement of Work
CRADA	Cooperative Research & Development Agreement

EPA

United States Environmental Pro
Washington, DC

Work Assignm

NO SOW for Amendment 001

ndment Number:
001

Contract Number	Contract Period 04/01/201	Name
EP-C-15-008	Base Option P	ents to Inh

Contractor
JACOBS TECHNOLOGY INC.

Purpose:
- [ ] Work Assignment
- [X] Work Assignment Amendment
- [ ] Work Plan Approval
- [ ] Work Assi
- [ ] Increment

03/31/2018

Comments:
This amendment is to add John Archer as the COR and add A
as the Alt. COR. All other terms and conditions remain u

[ ] 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: 04/01/2017 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 John Archer	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-1151 FAX Number:
Project Officer Name Melissa Revely-Wilson	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-0207 FAX Number:
Other Agency Official Name Keith Pfeffer	(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:

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-083

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number 2

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 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17

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

SFO (Max 2) ☐

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This Action:

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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

WA Title: **EVALUATION OF DECONTAMINATION AND SAMPLING METHODS FOR BIOLOGICAL AGENTS**

WA #: 2-83 WACOR: CALFEE

Contract #: EP-C-15-008 Alternate WACOR: LEE

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

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.

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.

The 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. Within NHSRC, Decontamination and Consequence Management Division (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 the Office of Land and Emergency Management (OLEM) and the Office of Chemical Safety and Pollution Prevention (OCSPP). OLEM, through its Special Teams, supports the emergency response functions carried out by the Regional Offices. OCSPP 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 the Federal Insecticide, Fungicide, Rodenticide Act (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 (the Program to Align Research with the Needs of Emergency Response).

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", and to determine the effectiveness of sampling approaches used to assess decontamination effectiveness. Decontamination methods shall be 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 on use for the remediation of the wooden shed in Danbury, CT.

TECHNICAL APROACH/OBJECTIVES

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).

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 five major tasks. The specific details related to these tasks are described below.

Task 1: QAPP

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 B (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: Evaluation of Composite Sampling Approaches

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. Composite and discrete collection approaches shall be evaluated. For these tests, experimentation shall be carried out in accordance with the QAPP. Deviations from the QAPP shall be documented in writing and justified.

Additionally, a draft journal manuscript shall be prepared from the data. The first draft of the manuscript shall be delivered by 2-1-2018.

Table 1. Conceptual Test Matrix for Task 2 – Evaluation of Composite Sampling

Device	Sampled Area (#areas x ft^2 each)	Material Types	Spore Surface Concentration	Replicates
37mm Vacuum Cassette	1 x 1	Carpet	E3, E6	5 test, 1 blank, 1 procedural blank
		Concrete		
	4 x 1	Carpet		
		Concrete		
	8 x 1	Carpet		
		Concrete		

Task 3: Evaluation of Operationally Challenging Decontamination

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: Conceptual Test Matrix for Task 3

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	

- 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: Evaluation of Spray Equipment with Cold Temperature Decontamination Formulations

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. Procurement of spray devices may be necessary.

Table 3. Conceptual Test Matrix for Task 4 - Decontaminant Formulation Compatibility

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			

Task 5: Reporting

Data 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 (Decontamination Technologies Research Laboratory) 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. These 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.

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

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.

No equipment or instrument purchases will be required for this WA.

QUALITY ASSURANCE

Prior to initiation of the testing described in the tasks above, a draft quality assurance project plan (QAPP) amendment shall be provided to EPA for review and comment, 20 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. See Task 1 for details on QAPP requirements.

DELIVERABLES

Deliverables from the tasks within this Work Assignment shall be generated and delivered according to the schedule in Table 4. Note: Five discrete report deliverables are required under this WA.

1. **Composite Sampling** – A data summary report shall be prepared and delivered to the WACOR by 9/1/2017. A draft manuscript shall be prepared and delivered by 2-1-2018, compiling data from WA 1-083 and 2-083.
2. **Composite Sampling Manuscript** – A draft journal manuscript shall be prepared from the data. The first draft of the manuscript shall be delivered by 2-1-2018. The manuscript shall be written in the style of PLoS ONE.
3. **Cold Weather Decon** - A draft final report, for the cold temperature decon data (under WA 0-060 and 1-060) shall be provided by 5/1/2017. A final report, detailing the test results and lessons learned from the testing shall be submitted to the EPA WACOR

following 3 rounds of edits, and no later than 6/15/2017. The report shall include any digital photos necessary to illustrate the findings. This report shall conform to the EPA Report Guidelines outlined in the Reporting Requirements section below.

4. **Operationally Challenging Decon** - A data summary report shall be prepared and delivered to the WACOR by 9/1/2017. The data report shall include data collected under the current WA.
5. **Soiled Surfaces Decon Manuscript** – A draft manuscript summarizing the test methods, results, conclusions and discussion shall be prepared for data collected under WA 0-063 and 1-063. The manuscript shall be formatted for publication in the *Journal of Applied Microbiology*. Two revisions of the draft shall be conducted. The first draft shall be provided on or before 9/15/2017.

Reporting Requirements:

- The monthly invoice reports for this work assignment shall provide a detailed description of any 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 (with the contractor), 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 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.

SCHEDULE of DELIVERABLES

The deliverables previously described in this PWS with the scheduled due date are shown in Table 4.

Table 4: Deliverable Inventory and Schedule

Deliverable	Due Date
QAPP Amendment (if necessary)	20 working days after initiation of this Work Assignment
Composite Sampling Data Report	10 months after initiation of this Work Assignment
Composite Sampling Manuscript (draft)	10 months after initiation of this Work Assignment
Cold Weather Decon Draft Report	5/1/2017
Cold Weather Decon Final Report	6/15/2017
Operationally Challenging Data Report	10 months after initiation of this Work Assignment
Soiled Surface Decon Manuscript (draft)	5 months after initiation of this Work Assignment

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.

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

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QAPP	Quality Assurance Project Plan	QMP	Quality Management Plan
QS	Quality System	SOW	Statement of Work
PI	Principal Investigator	CRADA	Cooperative Research & Development Agreement

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-084

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number 2

Title of Work Assignment/SF Site Name: Developing Remediation Tools

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 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17

☐ 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										
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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 Stuart Willison	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7253
			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: **Developing Remediation Tools, Including Surface Wipe Sampling Methods, for Evaluating Indoor Contamination from Pesticide Misuse**

Short Title: **Pesticide Misuse Tools**

WA #: 2-084 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 October 31, 2017.

NOTE: This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment # 1-084.

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. Most of the work for this work assignment will have been completed under WA1-084. The extension required for WA2-084 will be for any samples not completed in Tasks 1a and 2a and to provide analytical support from WA1-084.

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[1][2][3][4], 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

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[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.

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 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 complete the work from WA 1-084, including analysis and data reporting for the wiping parameters and how they affect recovery efficiencies from the generated extracts from the wipe sampling studies and from small coupon decontamination testing. Most of the work for this work assignment will have been completed under WA1-084. The extension required for WA2-084 will be for any samples not completed in Tasks 1a and 2a and to provide analytical support from WA1-084.

TECHNICAL APROACH/OBJECTIVES

Details for the general technical approach can be found below. The contractor shall conduct complete the 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 from which was not completed in WA1-084. Each tested variable is further described within the phases described in QAPP from WA1-084.

The QAPP was already developed in the previous work assignment and this work assignment will only complete the remaining analyses of the collected samples. The existing QAPP (WA #: 1-084) should be followed to meet all requirements described below. The QAPP entitled "Developing Remediation Tools, Including Surface Wipe Sampling Methods, for Evaluating Indoor Contamination from Pesticide Misuse" was approved by EPA on April 25, 2016. Should amendments to the QAPP be required, the contractor shall prepare amendments to the QAPP in accordance with Quality Assurance (QA) **Category B.**

Attachment 1 to this Performance Work Statement (PWS) provides information regarding NHSRC QA Requirements/Definitions List. An amendment to the QAPP must be approved prior to the start of any data collection described in such amendment. Additional information related to QA requirements can be found at www.epa.gov/quality.

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 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.

Task 1: Wipe Sampling: Completed

Any remaining work not completed from Work Assignment 1-084, Phase 2 will be completed within Work Assignment 2-084. Phase 2 experiments included a series of experiments focusing on the analytes listed in Table 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 1. Lastly, any experiments not completed from WA 1-084 (Phase 3), will be completed in WA-2-084. Phase 3 investigated 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 2. The remaining funds from WA 1-084 shall be used for WA 2-084 to ensure completion of each Phase and any modifications, which may be needed to ensure proper investigations are performed.

Task 1a:

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). Because the study is intended to mimic real-world scenarios, formulations (one for each listed pesticide) will be tested in Phase 2 alongside tested neat pesticides. A tentative Phase 2 plan is as follows:

Table 1. Phase 2, Down select solvent to study Phase 2.

Pesticide	Wipe/Solvent (IPA)	Low concentration	Medium concentration (may be dropped if unnecessary)	High concentration
-	IPA pre-wetted wipe	COTS	COTS	COTS

-	**Gauze Wipe**	**COTS**	**COTS**	**COTS**
-	**Option 1 or 2 (if necessary)**	**COTS**	**COTS**	**COTS**
Malathion	*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
Malathion Formulation	Same as above for Malathion	Same as above for Malathion		Same as above for Malathion
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
Carbaryl Formulation	Same as above for Carbaryl	Same as above for Carbaryl		Same as above for Carbaryl

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. If procedures mimic those from previous Phases, then repeating experiments will not be necessary. For example, if wipes tested on a surface (e.g., steel) in Phase 1, then it will not need to be repeated in Phase 3, in order to save costs; however, formulations will need to be tested on surfaces if wipe/formulation combinations were not previously tested. Neat chemicals and their formulation products will be tested in Phase 3 as listed in Table 3.

Task 2a.

Table 2. Phase 3, down select number of wipes and potential concentration to study Phase 3

Pesticide	Wipe Type & Solvent(s) (IPA pre-wetted wipe and/or Option 1 or 2)	Surface 1* (required, e.g., Painted Drywall)	Surface 2* (e.g., Laminate)	Surface 3 (e.g., stainless steel, porcelain tile)*
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
Malathion 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
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
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 WACOR. The contractor shall also add the internal standards (provided by the EPA WACOR) 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 technical approach section 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 October 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 WACOR 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
1a	Extracts from Phases 2 for Wipe Sampling	60 days from Phase 1 completion
2a	Extracts from Phases 3 for Wipe Sampling	60 days from Phase 2 completion
	Analytical Support for 1a and 2a	90 days

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 WACOR 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: 2-088

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008	Contract Period: 04/01/2015 To 03/31/2018 Base Option Period Number 2	Title of Work Assignment/SF Site Name: Impact of Methyl Bromide
Contractor: JACOBS TECHNOLOGY INC.	Specify Section and paragraph of Contract SOW: 2A, 2B, 2E, 2F, 2G, 2H, 2J	

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

Period of Performance: From 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17

☐ 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 03/31/2018 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: 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

WA Title: Impact of Methyl Bromide and Methyl Iodide Fumigations on Electronic Equipment

WA #: 2-088 WACOR: Sang Don Lee

Contract #: EP-C-15-008 Alternate WACOR: Shannon Serre

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

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.

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.

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.

TECHNICAL APROACH/OBJECTIVES

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.

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.

Task 1. QAPP

The contractor shall use the existing QAPP and if necessary revise the existing QAPP to conduct Task 2.

Task 2. Technical Support

The contractor shall provide technical support, operating experience, analytical support, and expendable materials to conduct the post fumigation tests following the fumigation conducted under WA 1-088. This support shall include:

- Provide expendable materials and supplies to conduct coupons, electronic equipment, biological indicators, as appropriate.
- Provide engineering and operating labor for the design and execution of post fumigation tests.

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

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. 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.

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 shall arrange periodic project meetings to discuss Task-specific progress, issues, and action items.

2. QAPP and Work Plan: QAPP amendment and Work Plan shall be provided within 30 days of the award of this agreement. This shall be provided prior to commencement of the task described within this PWS.

SCHEDULE of DELIVERABLES

Task Progress and Cost Reports	Monthly
QAPP Revisions	Within 30 days of WA initiation

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	IAG	Interagency Agreement
NHSRC	National Homeland Security Research Center	QA	Quality Assurance
QA ID	Quality Assurance Identification	QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan	QMP	Quality Management Plan
QS	Quality System	SOW	Statement of Work
PI	Principal Investigator	CRADA	Cooperative Research & Development Agreement

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-089

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number 2

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 04/01/2017 To 03/31/2018

Comments:
Work plan due by 4/21/17.

☐ 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 03/31/2018 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 Joe Wood	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-5029
			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

WA Title: Evaluation of Street Sweepers for Spore Removal
Work Assignment 2-089
WACOR: Joseph Wood
Alternate WA COR: Worth Calfee
CONTRACT: EP-C-15-008
Project# HS8.62.01 - 320

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

SUMMARY OF OBJECTIVES

Using the walk behind sweeper purchased under WA 1-089, experiments will be conducted to evaluate how well the sweeper removes and collects bacterial spores. 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. A QAPP was already developed under WA 1-089, so no new QAPP will be developed.

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.

SCOPE

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.

TECHNICAL APPROACH/OBJECTIVES

Experiments shall be conducted to evaluate how well the sweeper (purchased under previous WA) removes and collects bacterial spores 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.

The contactor shall perform the following tasks. The work conducted under this WA is a continuation of the work performed under WA 1-089. Under no circumstances shall work be duplicated under this new WA.

Task 1. Conduct experiments with the street sweeper

The contractor shall conduct testing according to the QAPP developed under WA 1-089 and per the following requirements:

A. All work conducted in the bio-contaminant laboratory for this sub-task shall be charged to WA 2-061 of this contract.
B. Conduct 8 experiments to quantify the removal and capture of spores and/or microspheres from simulated street surfaces, and the generation of spore aerosols. Initial test conditions shall be selected in consultation with the WACOR and follow-on test conditions shall be selected based on results of ongoing tests. That is, in consultation with the WACOR, the test matrix will be adjusted as testing proceeds. Experimental variables may include, but are not limited to type of pavement surface, use of water or sporicidal liquid (if dust suppression is used), area vacuumed, rate of vacuuming, etc.

Task 2. Provide general support for maintaining the lab equipment.
This support shall include assembly, maintenance, troubleshooting, and configuration support for any equipment used for testing. Support shall also include the purchase of any expendable materials, with prior approval from the WACOR, for use in this project.

Task 3. Report the results of all tests to the WACOR as soon as possible.
Report the results of each test to the WACRO within 7 days, via email and through the use of the DTRL share drive. The WACOR 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 4. Analyze the data
Analyze the data per the requirements in the QAPP and in consultation with the WACOR, 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 5. Meet with the WACOR
The contractor shall meet with the WACOR 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 6. 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 7. Prepare test report
Prepare a draft test report, and based on comments received from WACOR, 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".

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

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.

QUALITY ASSURANCE

Tasks shall be completed according to the Quality Assurance Project Plan developed under the previous WA.

DELIVERABLES

Data Delivery

Raw data from the biolab (e.g., plate counts, qualitative growth results, etc.) shall be emailed to the WACOR, and by carbon copy (cc) to the WACOR 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 WACOR. 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 WACORs, (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 WACOR the same day the quarterly report is delivered.

SCHEDULE OF DELIVERABLES

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, 2017. Dates dependent upon completion of specific tasks shall be updated based on discussions between the contractor WAL and EPA WACOR during the development of the test plans to cover the work specified herein.

Suggested Deliverable Schedule

Deliverable	**Completion Date**
Submit work assignment plan	4/21/17
Complete Task 1	8/1/17
Submit draft test report (Task 7)	9/1/17
Submit final report (Task 7)	10/1/17

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-090

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number 2

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 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17

☐ 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 03/31/2018 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 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

Performance Statement of Work

WA Title: Fate and Transport of Pesticides across a Permeable Layer into a Porous Subsurface

WA #: 2-090 WACOR: Lukas Oudejans

Contract #: EP-C-15-008 Alternate WACOR: Anne Mikelonis

NHSRC Project Number: HS8.43.02-1024

NOTE: ***This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment # 1-090.***

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, 2018.

1. SUMMARY OF OBJECTIVES

This work will wrap up an assessment of the fate and transport of pesticides into paint or other coatings as commonly encountered in building infrastructure.

2. BACKGROUND

There has been an increase in pesticide misuse incidents for controlling bed bugs and other insects in indoor environments. These incidents include pesticide products not registered by the US EPA for indoor use or approved pesticide products that are improperly applied or at concentrations that exceed the labeled rates. The bed bug epidemic is resulting in a growing number of incidents. 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.

Clean up activities following a mis-or overuse of pesticides have been hampered by a lack of information on efficacious (surface) decontamination options. Some of the response recommendations are based on decontamination options for organophosphate chemical warfare agents (CWAs) for which more information is currently available. As has been observed in the case of the decontamination of CWAs, the efficacy of a liquid decontaminant is material dependent which can be attributed in part to the potential permeability or porosity of a material. The transport of a chemical into a permeable material makes it more difficult to decontaminate as a water based decontaminant would not be able to reach the permeated chemical, let alone if the chemical is transferred even further into a porous material under the painted or coated layer. If this happens, a chemical of concern may resurface after the

decontamination has taken place, recreating the hazard. A recent study confirmed that chemical agents may absorb into a paint or coating and even transfer further into a porous substrate below the paint or coating.

3. SCOPE

As initiated under WA 1-090, this study assesses the fate and transport of a selected group of pesticides that have been mis-or overused into painted materials commonly encountered in indoor environments. This study would identify whether decontamination approaches may need to be optimized for decontamination of these painted surfaces. This follow up WA will continue with the actual demonstration of the functionality of a developed apparatus if not completed under WA 1-090 followed by the data report writing

4. TECHNICAL APROACH/OBJECTIVES

The main objective is to determine the partitioning of a pesticide across a painted or coated porous material. In general, it is impossible to separate paint or coating layer(s) from a porous material such as dry wall board, wood or concrete without the use of strong physical or chemical removal/separation methods that would alter the residual pesticide amounts. Therefore, this study will compartmentalize the layered structure to understand the transport of a pesticide as deposited on the permeable paint surface, into the paint surface, and potentially into the underlying porous material. The porous material will be represented here by a solid phase extraction (SPE) disk. The actual measurement of chemical amounts will be conducted at various intervals of the dwell time of the pesticide on the surfaces as to follow the time dependence of the permeation process.

The contractor shall perform the following specific tasks as part of this work assignment but only if they have not been completed under previous WA 1-090.

TASK 1: Preparation of the Quality Assurance Project Plan (QAPP)

The contractor shall continue to work under the approved QAPP entitled "Fate and Transport of Pesticides across a Permeable Layer into a Porous Subsurface" as approved by ORD/NHSRC QA on January 17, 2017. Any amendments to this QAPP must be approved prior to the start of any literature searches (existing data), data collection, gathering, synthesizing, or data generation (laboratory) work.

TASK 2. Transport of pesticide into paint

This task shall only be executed by the contractor if not completed under WA 1-090.

The contractor shall utilize the constructed devices that can be used to (1) sample a chemical applied to a free standing paint layer by wiping of the painted surface; (2)

extract the chemical from the free standing paint film; and (3) extract the chemical from the SPE disk positioned below the free standing paint layer.

The contractor shall construct a test matrix that will allow for measurement of residual malathion at four (4) time intervals up to 72 hr following the deposition of the malathion onto the painted coupon surface. At each point in time, the remaining amounts of malathion shall be determined through a combination of wiping and extraction of the coupon types and quantities as shown in Table 1. The contractor shall consider one paint type at this time. A nominal 2 µL droplet shall be deposited on each coupon. Information on paint type and pesticide (malathion) has been provided by the EPA WACOR during the development of the QAPP. The contractor shall deliver sample extracts for the analysis to the in-house EPA analytical laboratory.

Table 1: Test Matrix

Chemical	Dwell Time (hr)	Spike Control	Method	SS	Painted SS	Painted SPE	Total Samples
Pesticide I	3	3	Wipe	3	3	3	9
			Extraction	3	3	3+3	12
	6	3	Wipe	3	3	3	9
			Extraction	3	3	3+3	12
	24	3	Wipe	3	3	3	9
			Extraction	3	3	3+3	12
	72	3	Wipe	3	3	3	9
			Extraction	3	3	3+3	12

TASK 3. Test Report

The EPA WACOR will receive the analytical results from the in-house EPA analytical laboratory. Upon receipt, the WACOR will inform the contractor that the samples have been processed and that the results are ready for further interpretation.

The contractor shall generate a draft test report detailing a summary of method development and demonstration tests, findings, test conditions, methods, quality assurance, test results, and lessons learned from the testing under the method development as executed under WA 1-090 and Task 2 identified above. This report shall include all procedural steps and any digital photos necessary to illustrate the findings. This draft version will be reviewed by the EPA WAM and EPA product team.

A final version 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.

5. QUALITY ASSURANCE

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 create a draft data summary report and a final data summary report as per Task 3 description following receipt of the analytical results.

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***
Task 2 – Completion of test matrix	4 weeks after award of WA
Draft Test Report – Task 3	4 weeks after receipt of analytical results from Task 2
Final Test Report – Task 3	2 weeks after receipt of comments from EPA WACOR and project team

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-091

☐ Other ☐ Amendment Number:

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 2	DECONTAMINATION LINE PROTOCOL

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 2.0 I, J

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

Period of Performance: From 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17

☐ 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 03/31/2018 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

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Performance Work Statement

WA Title: DECONTAMINATION LINE PROTOCOL EVALUATION FOR BIOLOGICAL CONTAMINATION INCIDENTS USING ELECTROSTATIC SPRAY

WA #: 2-091 WACOR: John Archer

Contract #: EP-C-15-008 Alternate WACOR: Leroy Mickelsen

NOTE: This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment #1-091. It is anticipated that the Quality Assurance Project Plan (QAPP), test plan, and Health and Safety Plan (HASP) will be submitted during Option Period 1 and that the study and report writing will conclude during Option Period 2.

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

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 areas using an electrostatic sprayer for personnel decontamination. Particular emphasis will be on personal protective equipment (PPE) entry points for worker contamination as well as ability of the electrostatic sprayer to prevent migration of biological contamination as compared to misting or spraying with a traditional sprayer. The results of this evaluation shall be compared to those identified in EPA Report EPA.600/R-14/476, 2015

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.

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 standard operating guideline based on the previous NHSRC PPE decontamination study. The current version of the decontamination line to be evaluated is attached.

SCOPE

The purpose of this study is to determine the effectiveness of the decontamination line procedure in preventing cross contamination of individuals or outside areas. The electrostatic sprayer will be tested to determine if it is more effective at decontamination and preventing biological cross contamination or migration from PPE than the previously modified biological decontamination procedure.

TECHNICAL APROACH/OBJECTIVES

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 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.

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

The contractor shall procure all test materials/equipment. Instrumentation for analysis is already onsite at EPA. The work is expected to be conducted at EPA's Research Triangle Park Facility. 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.

QUALITY ASSURANCE

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 which will be approved by the EPA NHSRC QA Manager. 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.

TASKS

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 21 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. **(Expected Completion in Option Period 1)**

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. **(Expected Completion in Option Period 1)**

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 B.

Methods used in the initial PPE decontamination line protocol evaluation shall be applied to test the use of electrostatic spray. Electrostatic spray shall be evaluated as to how effective it is at preventing migration of biological contamination from PPE compared to current misting procedure and water spray.

One additional aspect that may be considered is the decontamination and transfer of samples from the hot zone to the cold zone.

The contractor shall develop the health and safety protocol (HASP) 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 if necessary. **(Option Period 2)**

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. **(Option Period 2)**

Task 6 – Data Analysis for Operational Test Demonstration (OTD)

The contractor shall provide exposure assessment data analysis for industrial hygiene personal chlorine and biological spore exposure data that was collected during the Underground Transportation Restoration (UTR) OTD in the fall of 2016. All data will be provided by the WACOR to the contractor electronically. Data analysis shall include general descriptive statistical analyses, establishment/comparison of similar exposure groups, and generation of graphs, tables, and exposure heat mapping from real-time personal exposure data. The resulting data will be used in a journal publication. The contractor shall work with the EPA WACOR to finalize the data analysis and submit to include relevant discussion of the data. Submission shall be via posting on the NHSRC share drive and by hard copy to the WACOR. **(Option Period 2)**

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, quarterly and cumulative financial expenditures and cost and schedule variance.

- A draft report shall be delivered to the EPA WACOR by 7/1/17.

SCHEDULE of DELIVERABLES

Table 1: Deliverable Schedule

Deliverable	**Date**
QAPP/Test Plan	**To be submitted during previous option period**
Data summaries	On-going
Draft Report	7/1/2017
Final Report	2 weeks after receiving review comments

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 may be authored or co-authored by the EPA 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 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.

Attachment A 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
IAG	Interagency Agreement
NHSRC	National Homeland Security Research Center
PI	Principal Investigator
QA	Quality Assurance
QA ID	Quality Assurance Identification
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QMP	Quality Management Plan
QS	Quality System
SOW	Statement of Work
CRADA	Cooperative Research & Development Agreement

Attachment B

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 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

[1] PPE level may be upgraded based upon the decontamination agent being used on site.

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.**

4. **Suit Tape**

[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.

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 and turned on.

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 (no tape);
  2. Put on inner suit (Tyvek), leaving hood off;
  3. Put on outer gloves and tape to the inner Tyvek suit;
  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.

<u>Disposal of Decon Waste</u>: ***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 <u>prior</u> 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.

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[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.

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[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 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.

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.

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[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

Step #6: Mask Removal

HZ Worker:

- If wearing a PAPR, unscrew the hose from the BMA.
- 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.

[8] Recommend HEPA cartridges for workers, the attendants should consider HEPA + Cl2 if they spend much time on the decon line.

- Shower using copious quantities of disinfectant soap and water for a minimum of 5 minutes.
- Change into clean clothes.[9]
- Replenish fluids.

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.).

[9] The pre-deployment equipment list should include a clean change of clothes for all workers.

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.

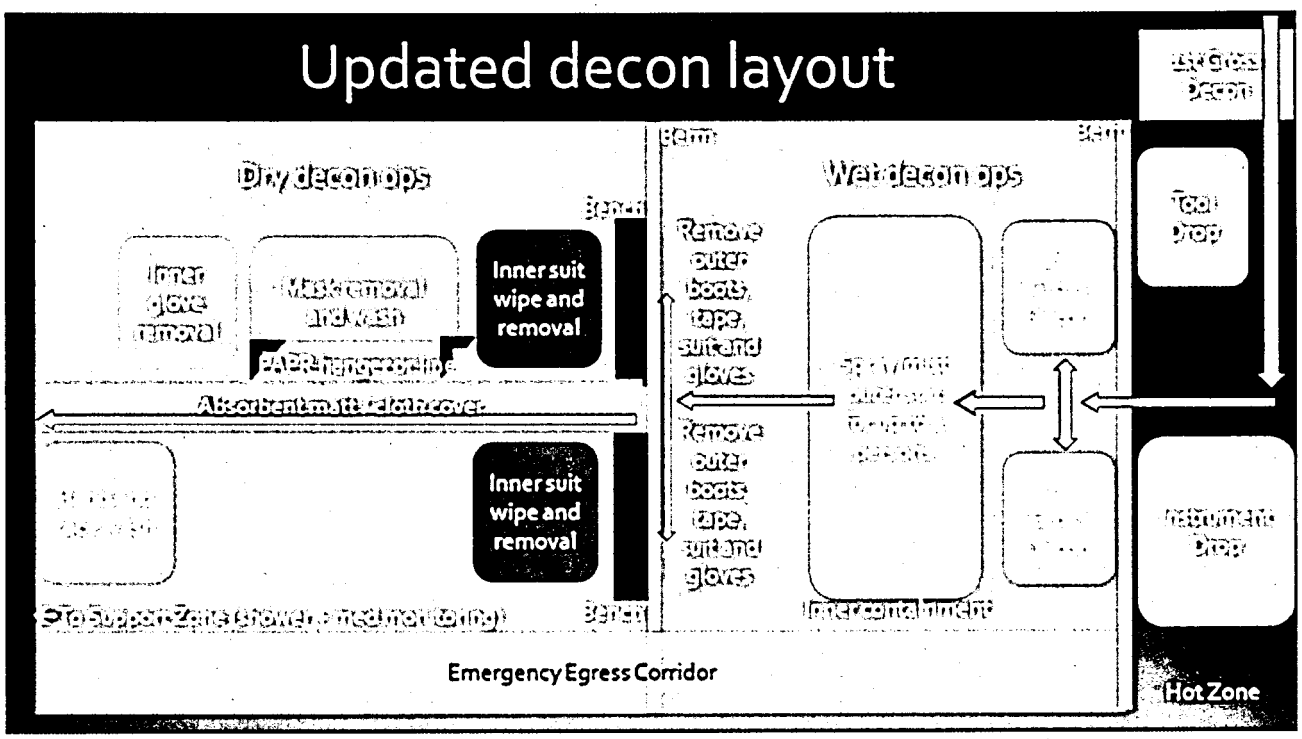
- ☐ Outer suit, boot and glove wash (disinfection);
  - ➢ Need a large enough area to process multiple workers (up to 4) simultaneously;
  - ➢ Use curtains or tarps to limit overspray, Use timers to ensure good contact time.
  - ➢ Ensure workers get completely sprayed/wiped and remain wet for the entire 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 <u>outer suit only</u> 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: 2-091

☐ 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 2	Decontamination Line Protocol

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: Section 2.0, Paragraph I and J

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

Period of Performance: From 04/01/2017 To 03/31/2018

Comments:
The purpose of this amendment is to revise the PWS. A revised technical memo and cost estimate is due within 20 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 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 Candice Charlton	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2007 FAX Number:

Performance Work Statement

WA Title: DECONTAMINATION LINE PROTOCOL EVALUATION FOR BIOLOGICAL CONTAMINATION INCIDENTS USING ELECTROSTATIC SPRAY

WA #: 2-091 WACOR: John Archer

Contract #: EP-C-15-008 Alternate WACOR: Leroy Mickelsen

NOTE: This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment #1-091. It is anticipated that the Quality Assurance Project Plan (QAPP), test plan, and Health and Safety Plan (HASP) will be submitted during Option Period 1 and that the study and report writing will conclude during Option Period 2.

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

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 areas using an electrostatic sprayer for personnel decontamination. Particular emphasis will be on personal protective equipment (PPE) entry points for worker contamination as well as ability of the electrostatic sprayer to prevent migration of biological contamination as compared to misting or spraying with a traditional sprayer. The results of this evaluation shall be compared to those identified in EPA Report EPA.600/R-14/476, 2015

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.

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 standard operating guideline based on the previous NHSRC PPE decontamination study. The current version of the decontamination line to be evaluated is attached.

SCOPE

The purpose of this study is to determine the effectiveness of the decontamination line procedure in preventing cross contamination of individuals or outside areas. The electrostatic sprayer will be tested to determine if it is more effective at decontamination and preventing biological cross contamination or migration from PPE than the previously modified biological decontamination procedure.

TECHNICAL APROACH/OBJECTIVES

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 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.

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

The contractor shall procure all test materials/equipment. Instrumentation for analysis is already onsite at EPA. The work is expected to be conducted at EPA's Research Triangle Park Facility. 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.

QUALITY ASSURANCE

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 which will be approved by the EPA NHSRC QA Manager. 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.

TASKS

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 21 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. **(Expected Completion in Option Period 1)**

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. **(Expected Completion in Option Period 1)**

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 B.

Methods used in the initial PPE decontamination line protocol evaluation shall be applied to test the use of electrostatic spray. Electrostatic spray shall be evaluated as to how effective it is at preventing migration of biological contamination from PPE compared to current misting procedure and water spray. **Additionally, the decontamination efficacy of diluted bleach on various PPE materials will be evaluated while comparing the current spray procedure and electrostatic spray procedure.**

One additional aspect that may be considered is the decontamination and transfer of samples from the hot zone to the cold zone.

The contractor shall develop the health and safety protocol (HASP) 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 if necessary. **(Option Period 2)**

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. **(Option Period 2)**

Task 6 – Data Analysis for Operational Test Demonstration (OTD)

The contractor shall provide exposure assessment data analysis for industrial hygiene personal chlorine and biological spore exposure data that was collected during the Underground Transportation Restoration (UTR) OTD in the fall of 2016. All data will be provided by the WACOR to the contractor electronically. Data analysis shall include general descriptive statistical analyses, establishment/comparison of similar exposure groups, and generation of graphs, tables, and exposure heat mapping from real-time personal exposure data. The resulting data will be used in a journal publication. The contractor shall work with the EPA WACOR to finalize the data analysis and submit to include relevant

discussion of the data. Submission shall be via posting on the NHSRC share drive and by hard copy to the WACOR. **(Option Period 2)**

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, quarterly and cumulative financial expenditures and cost and schedule variance.

- A draft report shall be delivered to the EPA WACOR by 12/22/18.

SCHEDULE of DELIVERABLES

Table 1: Deliverable Schedule

Deliverable	**Date**
QAPP/Test Plan	**To be submitted during previous option period**
Data summaries	On-going
Draft Report	**12/22/2017**
Final Report	2 weeks after receiving review comments

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 may be authored or co-authored by the EPA 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 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.

Attachment A 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
IAG	Interagency Agreement
NHSRC	National Homeland Security Research Center
PI	Principal Investigator
QA	Quality Assurance
QA ID	Quality Assurance Identification
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QMP	Quality Management Plan
QS	Quality System
SOW	Statement of Work
CRADA	Cooperative Research & Development Agreement

Attachment B

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 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

[1] PPE level may be upgraded based upon the decontamination agent being used on site.

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.**

4. **Suit Tape**

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[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.

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.

<u>Disposal of Decon Waste</u>: ***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 <u>prior</u> 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.

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[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.

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[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 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.

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.

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[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

Step #6: Mask Removal

HZ Worker:

- If wearing a PAPR, unscrew the hose from the BMA.
- 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.

[8] Recommend HEPA cartridges for workers, the attendants should consider HEPA + Cl2 if they spend much time on the decon line.

- Shower using copious quantities of disinfectant soap and water for a minimum of 5 minutes.
- Change into clean clothes.[9]
- Replenish fluids.

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.).

[9] The pre-deployment equipment list should include a clean change of clothes for all workers.

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.

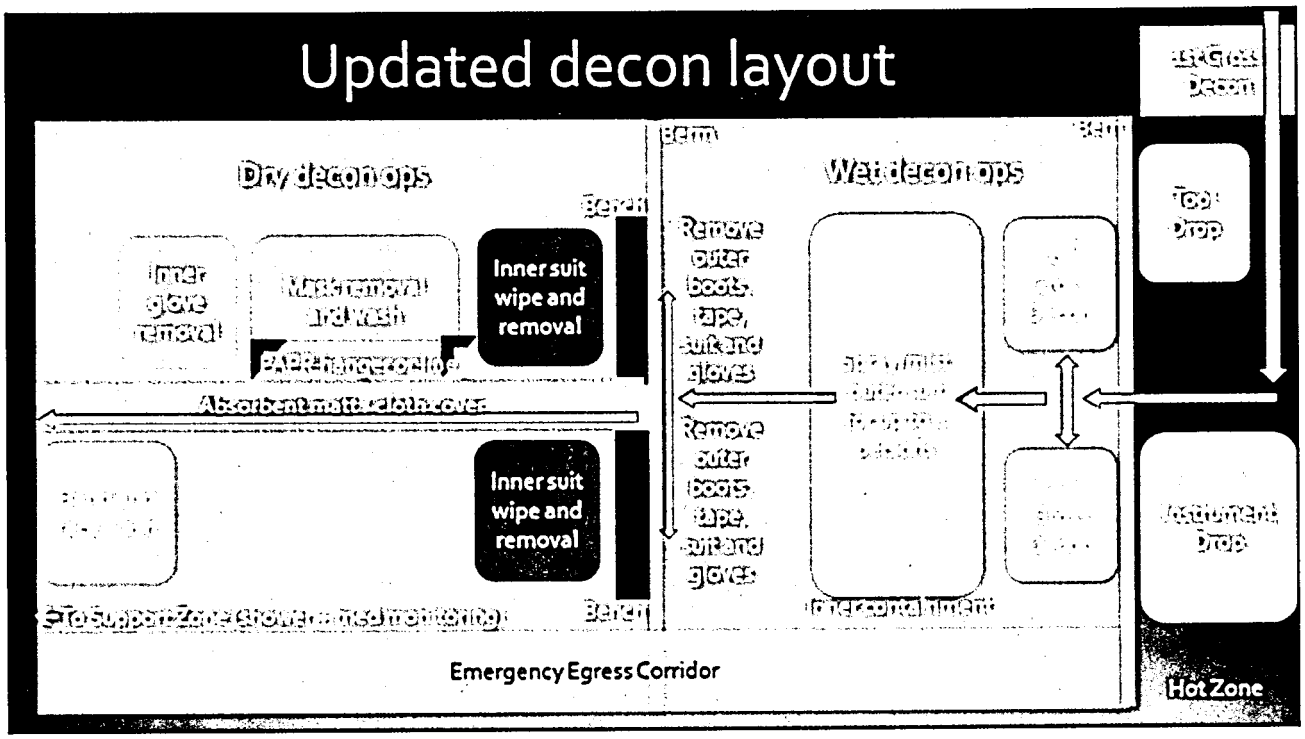
- ☐ Outer suit, boot and glove wash (disinfection);
  - ➢ Need a large enough area to process multiple workers (up to 4) simultaneously;
  - ➢ Use curtains or tarps to limit overspray, Use timers to ensure good contact time.
  - ➢ Ensure workers get completely sprayed/wiped and remain wet for the entire 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 <u>and</u> 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 <u>and</u> 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 <u>outer suit only</u> 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: 2-092

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018
Base Option Period Number 2

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 04/01/2017 To 03/31/2018

Comments:
Work plan due by 4/21/17

☐ 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 03/31/2018 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: 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

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.

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☐ **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.

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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)

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☐ **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	IAG	Interagency Agreement
NHSRC	National Homeland Security Research Center	QA	Quality Assurance
QA ID	Quality Assurance Identification	QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan	QMP	Quality Management Plan
QS	Quality System	SOW	Statement of Work
PI	Principal Investigator	CRADA	Cooperative Research & Development Agreement

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-093

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008	Contract Period: 04/01/2015 To 03/31/2018 Base Option Period Number 2	Title of Work Assignment/SF Site Name: Investigation of Air Sampling
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 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17

☐ 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 03/31/2018 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: 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

WA Title: Investigation of Air Sampling Schemes to Detect Reaerosolized Spores in Support of Clearance Decision-Making for Outdoor Areas following a Wide-Area Biological Material Release

WA #: 2-093 WACOR: John Archer

Contract #: EP-C-15-008 Alternate WACOR: Russell Wiener

NOTE: This work assignment is a new WA submitted for Option Period 2.

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

SUMMARY OF OBJECTIVES

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) and attempting to determine the most representative air sampling methods to use for detection and clearance. This research will aid decision-makers in "clearing" and assessing public health risk of an outdoor area that has been decontaminated following a biological material release.

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.

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 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 the most suitable clearance sampling scheme following decon of a wide area biological release outdoors. Factors to be considered include, but are not limited to, air sampling timing, location, and preferred sampling technologies to use. The U.S. Environmental Protection Agency (EPA)/National Homeland Security Research Center (NHSRC) will support this PWS.

SCOPE

The goal of this work is to evaluate reaerosolization of spores from outdoor surfaces due to natural environmental conditions and investigate the capabilities and limitations of environmental/industrial hygiene (IH) air sampling schemes to be used in the clearance determination process. The purpose of this Work Assignment (WA) is to conduct research to fill some of the key knowledge gaps in this area.

TECHNICAL APROACH/OBJECTIVES

The contractor, upon approval from the EPA WACOR, shall procure all test equipment and materials to be included in this project. See the TASKS section for a breakout of tasks covered under this WA which include the technical approach.

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

It is estimated that this effort is labor intensive. Some sampling equipment and materials may need to be purchased under this WA. The contractor shall procure all test materials/equipment necessary for the work. Instrumentation for analysis is already onsite at EPA. The work is expected to be conducted at EPA's Research Triangle Park Facility.

QUALITY ASSURANCE

The contractor shall work with the EPA WACOR to develop the Quality Assurance Project Plan (QAPP) and test plan which will be approved by the EPA NHSRC QA Manager. NHSRC QA Requirements are listed in Attachment A. 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.

TASKS

A series of reports have been produced by EPA on prior studies to quantify 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. All prior reports and documentation for prior studies conducted for EPA will be made available to the contractor upon request.

The following tasks are defined as part of this work assignment:

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.

Task 2: Experimental design of controlled test:

The Contractor shall use an agreed upon surrogate spore 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 from natural processes and determine the most suitable clearance air sampling scheme for a wide area biological release outdoors. Area/environmental sampling techniques shall be

compared with personal sampling techniques. 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.

Task 3. Conduct controlled tests:

The contractor shall, upon approval from the WACOR, (including QAPP, IRB (if applicable), etc. approval) execute controlled experiments to assess reaerosolization of spores from defined surfaces due to environmental factors as described in Task 2. Measurement shall include multiple area or personal sampling technologies to measure air concentrations of spores.

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.

Task 5: Statistical Analysis and Technical Editing:

The contractor shall interpret study results 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.

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, quarterly and cumulative financial expenditures and cost and schedule variance.
- A draft report shall be delivered to the EPA WACOR by 9/1/17.

SCHEDULE of DELIVERABLES

Deliverable	Date
QAPP/Test Plan	Test Plan within 30 days of the Contracting Officer's signature. QAPP within 90 days.
Data summaries	On-going
Draft Report	9/1/2017

Final Report	2 weeks after receiving review comments

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 may be authored or co-authored by the EPA. 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.

Attachment A to the Statement of Work or Performance Work Statement

NHSRC QA Requirements/Definitions List

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Research of this nature meets one or more of the following criteria:

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

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Abbreviations:

COR	Contracting Officer
IAG	Interagency Agreement
NHSRC	National Homeland Security Research Center
PI	Principal Investigator
QA	Quality Assurance
QA ID	Quality Assurance Identification
QAM	Quality Assurance Manager
QAPP	Quality Assurance Project Plan
QMP	Quality Management Plan
QS	Quality System
SOW	Statement of Work
CRADA	Cooperative Research & Development Agreement

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-094

☐ Other ☐ Amendment Number:

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 2	Instrumentation and Data Suppo

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 08/24/2017 To 03/31/2018

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 03/31/2018 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 Anne Mikelonis	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-0579 FAX Number:
Project Officer Name Melissa Revely-Wilson	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-0207 FAX Number:
Other Agency Official Name Keith Pfeffer	(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: Instrumentation and Data Support for Fate and Transport Field Study

WA #: 2-094 WACOR: Anne Mikelonis

Contract #: EP-C-15-008 Alternate WACOR: Michael W. Calfee

NHSRC Project Number: HS8.43.01-0031

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

SUMMARY OF OBJECTIVES

The objective of this work assignment shall be to provide instrumentation and support for fate and transport research at a field testing location. The contractor shall provide, install, and maintain instruments that remotely monitor runoff (flow rate, velocity, and spore concentration), rainfall (intensity, velocity, droplet size, and kinetic energy), and soil parameters (moisture, pH, temperature and infiltration rate). The contractor shall also conduct one test onsite that samples the contamination at the site after a simulated rainfall event and washing with a hose and a power washer.

BACKGROUND

The field site for this work is the abandoned Chilocco Indian Agricultural School located in Kay County, Oklahoma near the border of Kansas. Chilocco is a 165 acre campus that includes buildings, paved streets, grassy areas, a lake and stormwater infrastructure (Figure 1).

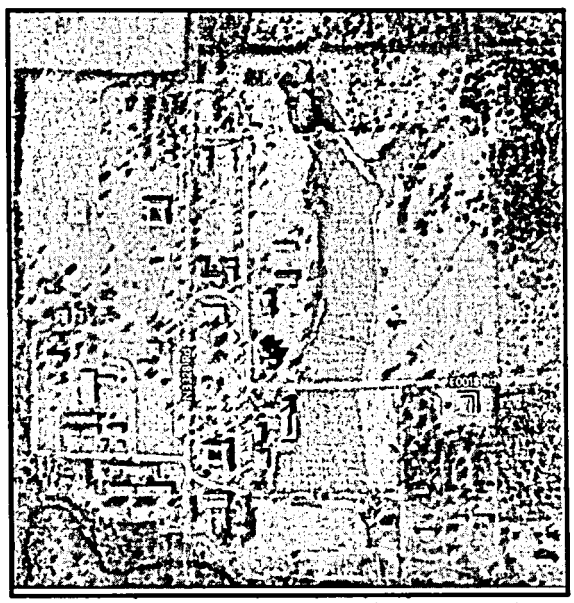

Figure 1: Arial View of Chilocco, OK

The site was selected for monitoring because the Department of Homeland Security is planning two releases of barcoded *Bacillus thuringiensis* subsp. *kurstaki* (BtK) spores (one during the winter in low humidity conditions and one during the summer during high humidity conditions). This work assignment 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, HS8.43.01-0031 is relevant to Long-Term Goal 2 (LTG-2) which states, "The Office of Solid Waste and Emergency Response (now 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 (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. The data collected during this project will inform spore removal and transport in an urban environment during a wide area incident and response and will support the calibration and validation of stormwater models for decision support during the recovery phase after an incident.

SCOPE

The purpose of this project is to supply the instrumentation and support staff necessary to determine the effectiveness of wash-down gross decon methods, rain, and overland flows (urban runoff) for removing spores from surfaces after a field release. The contractor shall supply, install, and maintain the necessary instrumentation and telemetry and periodically provide the staff to monitor and retrieve the data/samples from the site.

TECHNICAL APROACH/OBJECTIVES

The technical approach and objectives are described in detail under the following three tasks:

Task I QAPP & HASP

Prior to initiation of the testing described in the tasks below, a quality assurance project plan (QAPP) shall be provided to EPA for review and comment. After revision based upon EPA comments (as necessary) and approval by EPA, work may commence. The QAPP entitled "Assessment of Rain, Water Washdown, and Gross

Decontamination Methods for Reduction, Removal, or Inactivation of Spores on Urban Surfaces" as approved on November 8, 2016 (QAPP-1J16-003.A1) is particularly relevant to this work and shall be cited as necessary. The contractor shall also be responsible for maintaining an updated health and safety plan (HASP) for any laboratory or field testing.

Task II Field Instrumentation

The contractor shall provide field instrumentation for the site to monitor runoff and rainfall parameters prior to DHS's winter spore release (tentatively anytime between December and February). This instrumentation shall include at least one rainfall sensor that is capable of measuring droplet distribution size, velocity, intensity, and kinetic energy, one low profile velocity sensor to measure overland flow, sensors to measure soil moisture content, and a soil temperature and pH probe. Locations for the equipment installation shall be selected in consultation with the EPA WACOR. If the contractor does not have a sensor available for use under this work assignment, ~~R~~rental vs. purchase of equipment shall be considered when the contractor is conducting market research. If research should conclude the contractor should purchase the item it should submit the request in accordance with contract clause G-3, EPAAR 1552.245-70, Government Property. Additionally, the contractor shall automate up to five of EPA's ISCO autosamplers or devise another method to trigger rainwater runoff sample collection at a user specified time following rain events. The contractor shall provide the necessary power supply and telemetry to transmit the data throughout the project. They shall coordinate with University Multispectral Laboratories (UML) the maintainers of the Chilocco field site to ensure all power, communications (including directional wifi & proximity), and bandwidth are in place and operational before the first release.

Task III Conduct Field Washoff Test

The contractor shall conduct one washoff research test onsite within one month of each DHS release. This shall include the following aspects:

- Characterization, assembly, and onsite operation of an EPA supplied 12 ft. long by 12 ft. wide by approximately 5 ft. high rainfall simulator for a minimum of three hours at three rain intensities of increasing magnitude each hour.
- Logistical coordination and execution to wash two 12 ft. long portions of road; one with a hose and one with a power washer (at one select nozzle and distance per decision of the EPA WACOR).
- Sampling and analysis for Btk spores in areas used during the study. A minimum of 9 samples per round shall be used to characterize each wetted area (rain, hose, and powerwasher) pre and post test (a minimum total of 72 samples) unless an equivalent composite sampling scheme is proposed and tested.
- Collection and analysis of runoff water for spores, turbidity, pH, and total organic matter content at discrete time intervals for each test.

- All samples shall be transferred to an appropriate Microbiology Lab for pcr spore analysis 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 tests shall be extensively and adequately photographed and video documented to convey the test procedures.

Task IV Soil Infiltration

The contractor shall supply the necessary materials and logistics to characterize soil infiltration at the site following each release. They shall coordinate with the operators (UML) of the Chilocco site. This shall include three components of soil testing:

1) Sensors to track moisture content at different depths over time
   Time Domain Reflectometry (TDR) style moisture sensors shall be installed onsite prior to the first spore release and at least 3 distinct depths from 15 cm to 90 cm and at three locations on campus. Locations shall be selected in consultation with the EPA WACOR. A temperature and pH probe shall be installed nearby the soil moisture sensors. Telemetry and a plan for power supply shall be implemented to allow for remote monitoring and storage of the measured parameters for up to 3 months post release.

2) Infiltration test of the soil
   Infiltration tests shall be conducted in accordance with ASTM standard method D 3385 -94 and occur at a minimum of 3 locations on campus that shall be selected in consultation with the WACOR.

3) Compositional analysis of soil samples
   Analysis of soil properties shall include calcium, magnesium, moisture, zinc, percent sand, silt, and clay, USDA textural Class, % organic matter, cation exchange capacity, and bulk density from up to 5 sample locations.

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

The contractor~~Jacobs~~ shall identify the specific equipment and accessories necessary and shall submit all necessary property requests to the CO in accordance with the contract clause~~prior to purchase (GPAWS documentation)~~. Preliminary identification of the necessary key features and an example of each technology (Note, any similar piece of equipment is acceptable) are provided in Table 1: Equipment. Additionally, any instrument purchased shall have data logging and transmission capabilities. It is ~~expect~~anticipated that links and gateways compatible to the selected instrument shall be purchased and configured by the contractor for remote data collection.

Table 1. Equipment

Parameter	Key Features	Example Equipment
Rainfall Characterization	Operating Principle: • Laser Optical Disdrometer Measured Variables: • Intensity • Droplet size • Droplet Velocity	OTT Parsival[2] Laser Weather Sensor
One Low Profile Street Velocity Sensor & Depth Sensors	• Can measure velocity in street and flow in pipe • Can measure velocity in 2 inch or less depth water	Submerged AV Sensor
Soil Temperature and pH probe in 3 locations	• Conical tip for soil penetration	Halo HI12922 wireless soil pH Meter
3 Soil Moisture Sensor Locations	Operating Principle: • Time Domain Reflectometry (TDR) Monitoring minimum of 3 depths per location	Sensoterra

QUALITY ASSURANCE

The contractor shall be responsible for maintaining an approved QAPP. 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 related 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 field/laboratory journals, the use of digital photography and video, and data provided in excel spreadsheets or databases. This information shall be delivered in its reviewed form within one month of experimentation. The documentation should include, but not be limited to, key test variables and results, quality control measures outlined in the QAPP, 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.

DELIVERABLES

Deliverables are listed in Table 2. Deliverables and described in greater detail below.

Table 2. Deliverables

Deliverable	Due Date
QAPP & HASP Submitted	1 month post work assignment award
Sensor and telemetry evaluation memo	1 month post work assignment award
RTP demonstration of sensor function and telemetry	Prior to site deployment
Data Management Plan	Prior to site deployment & in coordination with overarching EPA field study at Chilocco
Installation of sensors	1 month pre spore release
SOP and remote access procedure for the installed sensors	2 weeks post sensor installation
Task III and IV Final Report	1 month post field experiments

Data

The contractor shall design a data management plan for sensor and sample information prior to the start of any work. This procedure shall be approved by the EPA for use, prior to conducting any testing described in this SOW. It shall also be accompanied by a detailed operating procedure for each experiment and a brief memo describing the data collected and identifying problems and resolutions encountered. All sensor equipment setup for the purposes of this project shall also include a detailed memo outlining the operational steps and equipment specifications.

Images

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.

Invoices

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 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 month from the test date. 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.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-094

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2019

Base Option Period Number: 2

Title of Work Assignment/SF Site Name: Instrumentation and Data

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 08/24/2017 To 03/31/2018

Comments:
The purpose of this amendment is to revise the PWS for a location change. Revisions are in red. A revised technical memo and cost estimate are due within 20 calendar 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 03/31/2019 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: Anne Mikelonis
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0579
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: Keith Pfeffer
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Performance Work Statement

Amendment

WA Title: Instrumentation and Data Support for Fate and Transport Field Study

WA #: 2-094 WACOR: Anne Mikelonis

Contract #: EP-C-15-008 Alternate WACOR: Michael W. Calfee

NHSRC Project Number: HS8.43.01-0031

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

SUMMARY OF OBJECTIVES

The objective of this work assignment shall be to provide instrumentation and support for fate and transport research at a field testing location. The contractor shall provide, install, and maintain instruments that remotely monitor runoff (flow rate, velocity, and spore concentration), rainfall (intensity, velocity, droplet size, and kinetic energy), and soil parameters (moisture, pH, temperature and infiltration rate). The contractor shall also conduct one test onsite that samples the contamination at the site after a simulated rainfall event and washing with a hose and a power washer.

BACKGROUND

The field site for this work is located at EPA's campus in Edison, New Jersey. This work assignment 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, HS8.43.01-0031 is relevant to Long-Term Goal 2 (LTG-2) which states, "The Office of Solid Waste and Emergency Response (now 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 (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. The data collected during this project will inform spore removal and transport in an urban environment during a wide area incident and response and will support the calibration and validation of stormwater models for decision support during the recovery phase after an incident.

SCOPE

The purpose of this project is to supply the instrumentation and support staff necessary to determine the effectiveness of wash-down gross decon methods, rain, and overland flows (urban runoff) for removing spores from surfaces after a field release. The contractor shall supply, install, and maintain the necessary instrumentation and telemetry and periodically provide the staff to monitor and retrieve the data/samples from the site.

TECHNICAL APROACH/OBJECTIVES

The technical approach and objectives are described in detail under the following three tasks:

Task I QAPP & HASP

Prior to initiation of the testing described in the tasks below, a quality assurance project plan (QAPP) shall be provided to EPA for review and comment. After revision based upon EPA comments (as necessary) and approval by EPA, work may commence. The QAPP entitled "Assessment of Rain, Water Washdown, and Gross Decontamination Methods for Reduction, Removal, or Inactivation of Spores on Urban Surfaces" as approved on November 8, 2016 (QAPP-1J16-003.A1) is particularly relevant to this work and should be cited as necessary. The contractor shall also be responsible for maintaining an updated health and safety plan (HASP) for any laboratory or field testing.

Task II Field Instrumentation

The contractor shall provide field instrumentation for the site to monitor runoff and rainfall parameters prior to spore release at the field location. This instrumentation shall include at least one rainfall sensor that is capable of measuring droplet distribution size, velocity, intensity, and kinetic energy, one low profile velocity sensor to measure overland flow, sensors to measure soil moisture content, and a soil temperature and pH probe. Locations for the equipment installation shall be selected in consultation with the EPA WACOR. Rental vs. purchase of equipment shall be considered when the contractor is conducting market research. Additionally, the contractor shall automate up to five of EPA's ISCO autosamplers or devise another method to trigger rainwater runoff sample collection at a user specified time following rain events. The contractor shall provide the necessary power supply and telemetry to transmit the data throughout the project. They shall coordinate the maintainers of the Edison field site to ensure all power,

communications (including directional wifi & proximity), and bandwidth are in place and operational before the first release.

Task III Conduct Field Washoff Test

The contractor shall conduct one washoff research test onsite within one month of each spore. This shall include the following aspects:

- Characterization, assembly, and onsite operation of an EPA supplied 12 ft. long by 12 ft. wide by approximately 5 ft. high rainfall simulator for a minimum of three hours at three rain intensities of increasing magnitude each hour.
- Logistical coordination and execution to wash two 12 ft. long portions of road; one with a hose and one with a power washer (at one select nozzle and distance per decision of the EPA WACOR).
- Sampling and analysis for Btk spores in areas used during the study. A minimum of 9 samples per round shall be used to characterize each wetted area (rain, hose, and powerwasher) pre and post test (a minimum total of 72 samples) unless an equivalent composite sampling scheme is proposed and tested.
- Collection and analysis of runoff water for spores, turbidity, pH, and total organic matter content at discrete time intervals for each test.
- All samples shall be transferred to an appropriate Microbiology Lab for pcr spore analysis 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 tests shall be extensively and adequately photographed and video documented to convey the test procedures.

Task IV Soil Infiltration

The contractor shall supply the necessary materials and logistics to characterize soil infiltration at the site following each release. They shall coordinate with the operators of the Edison site. This shall include three components of soil testing:

1) Sensors to track moisture content at different depths over time
   Time Domain Reflectometry (TDR) style moisture sensors shall be installed onsite prior to the first spore release and at least 3 distinct depths from 15 cm to 90 cm and at three locations on campus. Locations shall be selected in consultation with the EPA WACOR. A temperature and pH probe shall be installed nearby the soil moisture sensors. Telemetry and a plan for power supply shall be implemented to allow for remote monitoring and storage of the measured parameters for up to 3 months post release.

2) Infiltration test of the soil
Infiltration tests shall be conducted in accordance with ASTM standard method D 3385 -94 and occur at a minimum of 3 locations on campus that shall be selected in consultation with the WACOR.

3) Compositional analysis of soil samples
Analysis of soil properties shall include calcium, magnesium, moisture, zinc, percent sand, silt, and clay, USDA textural Class, % organic matter, cation exchange capacity, and bulk density from up to 5 sample locations.

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

Jacobs shall identify the specific equipment and accessories necessary and shall submit all necessary property requests to the CO prior to purchase (GPAWS documentation). Preliminarily identification of the necessary key features and an example of each technology (Note, any similar piece of equipment is acceptable) are provided in Table 1: Equipment. Additionally, any instrument purchased shall have data logging and transmission capabilities. It is expected that links and gateways compatible to the selected instrument shall be purchased and configured by the contractor for remote data collection.

Table 1. Equipment

Parameter	Key Features	Example Equipment
Rainfall Characterization	Operating Principle: • Laser Optical Disdrometer Measured Variables: • Intensity • Droplet size • Droplet Velocity	OTT Parsival[2] Laser Weather Sensor
One Low Profile Street Velocity Sensor & Depth Sensors	• Can measure velocity in street and flow in pipe • Can measure velocity in 2 inch or less depth water	Submerged AV Sensor
Soil Temperature and pH probe in up to 3 locations	• Conical tip for soil penetration	Halo HI12922 wireless soil pH Meter
Up to 3 Soil Moisture Sensor Locations	Operating Principle: • Time Domain Reflectometry (TDR) Monitoring minimum of 3 depths per location	Sensoterra

QUALITY ASSURANCE

The contractor shall be responsible for maintaining an approved QAPP. 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 related 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 field/laboratory journals, the use of digital photography and video, and data provided in excel spreadsheets or databases. This information shall be delivered in its reviewed form within one month of experimentation. The documentation should include, but not be limited to, key test variables and results, quality control measures outlined in the QAPP, 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.

DELIVERABLES

Deliverables are listed in Table 2. Deliverables and described in greater detail below.

Table 2. Deliverables

Deliverable	Due Date
QAPP & HASP Submitted	1 month post work assignment award
Sensor and telemetry evaluation memo	1 month post work assignment award
RTP demonstration of sensor function and telemetry	Prior to site deployment
Data Management Plan	Prior to site deployment
Installation of sensors	Pre spore release
SOP and remote access procedure for the installed sensors	2 weeks post sensor installation
Task III and IV Final Report	1 month post field experiments

Data

The contractor shall design a data management plan for sensor and sample information prior to the start of any work. This procedure shall be approved by the EPA for use, prior to conducting any testing described in this SOW. It shall also be accompanied by a detailed operating procedure for each experiment and a brief memo describing the data collected and identifying problems and resolutions encountered. All sensor equipment setup for the purposes of this project shall also include a detailed memo outlining the operational steps and equipment specifications.

Images

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.

Invoices

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 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 month from the test date. 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.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-100

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number 2

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 04/01/2017 To 03/31/2018

Comments:
Work plan due by April 21, 2017.

☐ 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 03/31/2018 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 Robert Vanderpool	(Signature)	(Date)	Branch/Mail Code:
		Phone Number: 919-541-7877
		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: R&E Program Support

WA #: 2-100 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, 2018. This work assignment is a continuation of work assignment 1-100.

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. NAAQSs 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 NAAQSs, (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 NAAQSs. The Process Modeling Research Branch (PMRB) 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 Contracting Officer Representative (COR) 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 and cost beyond ten percent (10%) of the amount in the approved work plan, the contractor, upon receiving such a technical directive, shall immediately contact the WACOR with a copy to the COR. After a technical meeting with the WACOR, either an amendment to the work assignment will be issued or a revised technical memo and cost estimate shall be submitted for review and approval through the COR and Contracting Officer.

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 "Reference and Equivalent Methods Program Support", QAPP-1J16-009.0.

DELIVERABLES

Work Plan. A work plan containing a cost estimate shall be provided to the Contracting Officer (CO), COR and WA COR.

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.

Task 2. Investigation of Technical Issues

The contractor shall provide a written report with results of each Technical Issue investigated.

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: 3/31/2018.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-103

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018
Base Option Period Number 2

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 04/01/2017 To 03/31/2018

Comments:
Work plan due by 4/21/17.

☐ 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 03/31/2018 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: Maribel Colon
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-5712
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: Next Generation Air Monitoring Technical Support

WA #: 2-103 WACOR: Maribel Colón

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

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

SUMMARY OF OBJECTIVES

This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment #1-103. This work assignment shall provide field and/or technical support involving the transfer of Next Generation Air Monitor (NGAM) technologies to EPA offices in Puerto Rico, also including the validation, transfer and summary of all data collected during the period of Oct. 2016 to March 2017 in support of the Environmental Justice (EJ) research taking place in the Tallaboa-Encarnación community in Peñuelas, Puerto Rico. Such efforts shall be associated under conditions defined 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 taking place on the RTP, NC campus 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 transfer of low cost sensor technologies, and the analysis and summary of the produced data.

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 transfer (make available) ten (10) sensor Pods systems located at the DISUR program offices (Ponce, PR) to EPA-Region 2 staff; clean, pack and ship a total of four (4) weather stations stored at the DISUR program offices (Ponce, PR) back to the WA COR located in RTP, NC using a WA COR approved shipping procedure; validate all data obtained during the duration of the 2016-2017 sensor pod deployment activities as well as all citizen science logs to meet QAPP requirements; provide EPA with copies of the raw data, field log book notes and citizen science log sheets; provide a WA COR-

approved Word-based 5-10 page document defining how the contractor will validate raw data, analyze validated data, and ultimately how they will summarize data findings to achieve environmental awareness. The ultimate goal of this effort being a reporting of lessons learned from the execution of this research effort.

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 may utilize a Ponce, Puerto Rico community action group to conduct research described in this work assignment. The contractor shall ensure that any community group, if utilized, is highly knowledgeable in the EPA's research efforts involving citizen science in Ponce as described in detail in the original WA 1-103. The contractor shall identify the community action group (CAG). Any CAG must have direct access to sensor data obtained during the original WA 1-103 as well as working knowledge of the databases created under the original effort. The

Contractor shall clean and pack the Pods prior to their release to EPA in Guaynabo, PR. Discussions between ORD/Region 2 and the selected CAG will ultimately dictate the full design of the data analysis. Technical direction by the WA COR will be used to guide key decision making aspects of the how the data will be handled and presented to ORD/Region 2 and the community. Monthly conference calls shall be established by the WA COR in which the Contractor shall participate.

The Contractor may partner with other community action groups, local academics, scientists, and/or government offices to create a document (5-10 pages maximum) that defines how the contractor will take validated data and summarize it to achieve environmental awareness. This document will be added as an Addendum to the already approved QAPP for this project. After all the data has been properly validated and summarized the Contractor shall prepare a WA COR-approved PowerPoint presentation that will highlight key findings of this project and present it to EPA and the community at the Tallaboa-Encarnación Community Center, Peñuelas, Puerto Rico.

TECHNICAL APROACH/OBJECTIVES

1. **Task #1. Compile and validate data and logs to meet full QAPP requirements**

   The Contractor shall flag raw data needing to be excluded with commentary directly on file. Document (in a Word file) all QA actions needed to validate data including field log notes. Save validated data in a new spreadsheet with all data now assembled in a single workbook (environmental + weather data). Contractor shall validate citizen science logs and recover data to yield a calendar-based record of reported environmental activities (Word file). Provide EPA with copies of the raw field log book notes and original citizen's log sheets. Provide EPA a Word copy of the calendar-based record of log and environmental notes that might have impacted data quality or environmental condition observations.

2. **Task #2. Development of a document stating how the Contractor will achieve environmental awareness**

   The Contractor shall develop a document (5-10 pages maximum) that defines how they will validate data and then summarize it to achieve environmental awareness goals of the EPA's project study design as identified in the project QAPP. The Contractor may partner with other community action groups, local academics, scientists, and/or government offices to best achieve this goal. Said partners may be available to assist with data analysis but ultimately the Contractor has to manage the full range of data analysis/data summarization activities. Once an analysis framework

has been proposed, EPA will review, and provide comments. EPA shall be given electronic copies of all data summarization tables, graphs, charts, statistical analyses, etc. developed as a result of this task. EPA shall provide review and commentary on these components.

3. **Task #3. DISUR shall conduct statistical and other analysis activities to summarize the environmental findings from the study**

   The Contractor shall include summaries of number of raw data points collected, number of validated data points collected (by parameters), summary of pod activities (deployment, collocation, recovery, maintenance, troubleshooting, etc). The Contractor shall use data collected from the collocation effort to normalize response between and among the individual sensor pods. A data set shall be developed that incorporates validated, normalized data. EPA shall be provided a copy of this electronic database for review and approval prior to any environmental summarization efforts.

4. **Task #4 Development of a Data Summary PowerPoint Presentation and Webinar**

   The Contractor shall develop a data summary (PowerPoint presentation) that highlights key findings. This Presentation shall incorporate a full history of all major activities (identification of primary organizations and timing of study activities, citizen science engagement, pod training, pod deployment, data recovery, database development, collocation activities, environmental log books, data validation steps, key environmental findings). Key environmental findings shall consist of 10-15 graphs/tables/plots that define noteworthy environmental conditions. These shall focus primarily on spatial and temporal relationships observations. Air quality modeling (impact of meteorological conditions) may be included in the summarization if the model used is one approved by the WACOR as part of its review of Task #2. The Contractor shall provide a webinar to EPA (using full range of available study documentation).

5. **Task #5 DISUR Formal EPA and community presentation, and future publication**

   The Contractor shall arrange/provide a location and a meeting date in the Ponce area of Puerto Rico to provide sufficient space and audiovisual equipment for a community meeting. The Contractor shall provide the EPA WACOR a minimum of 8 weeks advance notice of the time and date of this planned meeting. The Contractor shall be fully responsible for inviting community members to this assembly. EPA shall review and approve all

meeting materials released to the public in support of this meeting. The intended date for this meeting where a joint community EPA presentation on the findings of the research shall take place shall be in the early September 2017 time frame. The Contractor shall contribute to any EPA-developed secondary summarization of the study results following the community meeting. (EPA estimates this represents a maximum of 40 hrs.)

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

Transfer (release) pod systems from a Ponce location to EPA-Region 2 staff members in Guaynabo, Puerto Rico Clean up, box up and ship weather stations back to EPA/RTP.

QUALITY ASSURANCE

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: D-EMMD-AQB-003-QAPP-01 "Quality Assurance Project Plan for the Tallaboa-Encarnación Citizen Science Project" and the DISUR Citizen Science QAPP "Efficacy of Citizen Science Air Monitoring Using Low Cost Sensors". The Contractor shall develop an Addendum to the original QAPP stating how the contractor will validate and summarized the collected data.

DELIVERABLES and SCHEDULE of DELIVERABLES

1. The Contractor shall develop an Addendum to the original QAPP stating how they will validate and summarized the collected data. – **April 30**
2. Transfer (release) pod systems to local PR-based EPA Region 2 staff (have boxed up ready to go). – **April 30**
3. Clean up and box up and ship weather stations back to the WA COR (lowest cost possible). – **April 30**
4. Validate each individual data set to meet full QAPP requirements. Flag raw data needing to be excluded with commentary directly on file. Document (in a Word file, all QA actions needed to validate data) including field log notes. Save validated data in a new spreadsheet with all data now assembled in a single workbook (environmental + weather data). – **May 30**
5. Validate citizen science logs and recover data to yield a calendar-based notated record of reported environmental activities (Word file). Provide EPA with copies of the raw field log book notes and original citizens log sheets. Provide EPA a Word copy of the calendar-based record of log and environmental notes that might have impacted data quality or environmental condition observations. - **May 30**

6. Develop (propose to EPA) a data analysis framework (document) 5-10 pages maximum that defines how the Contractor will take validated data and summarize it to achieve environmental awareness. The Contractor may partner with other local academics, scientists, government offices to best achieve this goal. The WA COR will review all proposed PR-based partners prior to their inclusion in data sharing events. Said partners may assist with data analysis but ultimately the Contractor has to manage the full range of data analysis/data summarization activities. Once an analysis framework has been proposed, EPA will review, and provide commentary - **June 15**
7. The Contractor shall conduct statistical and other analysis activities to summarize the environmental findings from the study. This shall include summaries of # of raw data points collected, # of validated data points collected (by parameters), summary of pod activities (deployment, collocation, recovery, maintenance, troubleshooting, etc). The Contractor shall use data collected from the collocation effort to normalize response between and among the individual sensor pods. A data set shall be developed that incorporates validated, normalized data. EPA shall be provided a copy of this electronic database for review and approval prior to any environmental summarization efforts. – **July 30**
8. EPA shall be given electronic copies of all data summarization tables, graphs, charts, statistical analyses, etc developed as a result of point#5. EPA shall provide review and commentary on these components. - **July 30**
9. The Contractor shall develop a data summary (PowerPoint presentation) that highlights key findings. This Presentation shall incorporate a full history of all major activities (identification of primary organizations and timing of study activities, citizen science engagement, pod training, pod deployment, data recovery, database development, collocation activities, environmental log books, data validation steps, key environmental findings. Key environmental findings shall consist of 10-15 graphs/tables/plots that define noteworthy environmental conditions. These shall focus primarily on spatial and temporal relationships observations. Air quality modeling (impact of meteorological conditions) may be included in the summarization if the model used is one approved by the WACOR as part of its review of point #5. **– August 15**
10. The Contractor shall provide a webinar to EPA (using full range of available study documentations). **– August 30**
11. The Contractor shall arrange a meeting location and a meeting date in the Ponce area of Puerto Rico to provide sufficient space and audiovisual equipment for a community meeting. The contractor shall provide the EPA WACOR a minimum of 8 weeks advance notice of the date of this planned meeting. EPA shall review and approve all meeting materials released to the public in support of this meeting. The intended date for this meeting where a joint EPA presentation on the findings of the research shall take place shall be in the early September 2017 time frame. **– September 30**

12. The Contractor shall contribute to any EPA-developed secondary summarization of the study results to be used for its own primary purposes. **– March 30, 2018**

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-105

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number: 2

Title of Work Assignment/SF Site Name: Ambient Air Criteria Pollutant

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 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17

☐ 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 03/31/2018 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: 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: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

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 and to Supplement Regulatory Monitoring.

WA #: 2-105 **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, 2018.

SUMMARY OF OBJECTIVES

The purpose of this project is to identify, 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 wildland or prescribed fire research and 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. Mandated by the Clean Air Act and in 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. Additional areas 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 and wildland and prescribed fire emissions research) 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 routine and 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. Technical review of NO2, SO2, NOy and other criteria pollutant methods. The contractor shall perform review of the current 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 ambient air determination of "true" NO2, SO2, NOy, other criteria pollutants, precursor species and meteorological parameters. 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 Federal 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 NO2 NAAQS rulemaking packages 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. Currently, it is anticipated that the NO2 proposal date will be on or around July 14, 2017. 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 prior to the proposal deadline. 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, SO2, NOy, 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, SO2 NOy, 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 Lake Michigan Ozone Study (LMOS) during this performance period. The field campaign will be conducted in the State of Wisconsin with timing and exact siting TBD and issued through technical directive. It is anticipated that up to three weeks of contractor support will be needed on-site in Wisconsin. Additional filed campaigns involving wildland and prescribed fire emissions research mas also be conducted during the performance period of this work assignment. The WA COR will issue technical directive identifying the locations and duration of the fire emission research studies (including preparatory laboratory based activities), technical problem or methodology to be investigated/applied and the scope of the research.

Task 4. 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 sensing 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 and the deployment of next generation monitoring methods in wildland and prescribed fire emissions research studies. 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 Lake Michigan in the state of Wisconsin during the Spring/Summer 2017. Additional filed campaigns involving wildland and prescribed fire emissions research mas also be conducted during the performance period of this work assignment. The WA COR will issue technical directive identifying the locations and duration of the fire emission research studies (including preparatory laboratory based activities). The contractor shall compile the resulting test data and perform numerical and statistical analysis, as needed.

Task 5. 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 and towing vehicle.

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 D-EMMD-AQB-008-QAPP-02) 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 21 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: 2-105

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number: 2

Title of Work Assignment/SF Site Name: Methods Development, Evaluatio

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 04/01/2017 To 03/31/2018

Comments:
This amendment adds an additional task (Task 6) involving wildfire research. All equipment/materials to be purchased under Task 6 are considered WA-specific consumables. All other terms and conditions remain unchanged.

☐ 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										
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4										
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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: Russell Long
(Signature) (Date)
Branch/Mail Code:
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Project Officer Name: Robin S. Harris
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Contracting Official Name: Candice Charlton
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2007
FAX Number:

Performance Statement of Work

Amendment 000001

WA Title: Methods Development, Evaluation, and Applications for Ambient Air Criteria Pollutants, Key Precursor Species, and Meteorological Variables for use in and to Supplement Regulatory Monitoring.

WA #: 2-105 **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, 2018.

SUMMARY OF OBJECTIVES

The purpose of this project is to identify, 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 wildland or prescribed fire research and 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. Mandated by the Clean Air Act and in 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. Additional areas 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 and wildland and prescribed fire emissions research) 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 routine and 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. Technical review of NO2, SO2, NOy and other criteria pollutant methods. The contractor shall perform review of the current 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 ambient air determination of "true" NO2, SO2, NOy,

other criteria pollutants, precursor species and meteorological parameters. 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 Federal 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 NO2 NAAQS rulemaking packages 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. Currently, it is anticipated that the NO2 proposal date will be on or around July 14, 2017. 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 prior to the proposal deadline. 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, SO2, NOy, 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, SO2 NOy, 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 Lake Michigan Ozone Study (LMOS) during this performance period. The field campaign will be conducted in the State of Wisconsin with timing and exact siting TBD and issued through technical directive. It is anticipated that up to three weeks of contractor support will be needed on-site in Wisconsin. Additional filed campaigns involving wildland and prescribed fire emissions research mas also be conducted during the performance period of this work assignment. The WA COR will issue technical directive identifying the locations and duration of the fire emission research studies (including preparatory laboratory based activities), technical problem or methodology to be investigated/applied and the scope of the research.

Task 4. 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 sensing 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 and the deployment of next generation monitoring methods in wildland and prescribed fire emissions research studies. 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 Lake Michigan in the state of Wisconsin during the Spring/Summer 2017. Additional filed campaigns involving wildland and prescribed fire emissions research mas also be conducted during the performance period of this work assignment. The WA COR will issue technical directive identifying the locations and duration of the fire emission research studies (including preparatory laboratory based activities). The contractor shall compile the resulting test data and perform numerical and statistical analysis, as needed.

Task 5. 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.

Task 6. Provide on-site technical support for identification, evaluation, and application of conventional (reference) and next generation monitoring methods for gas phase pollutants (criteria gases, key precursor species and atmospheric reaction products), PM, and meteorological parameters (temperature, RH, wind speed and direction, mixing layer height, etc.) for use in characterizing wildfire emissions and resulting reaction products in ambient air. The research will include investigation of novel measurement technologies and the applicability of these methods to field intensive fire emission monitoring, 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. Under this task, the contractor may purchase select small sensor and remote sensing devices . The WACOR will provide written technical directive identifying the items needed, all anticipated to be consumed during the period of performance of the WA. The contractor shall compile the resulting test data and perform numerical and statistical analysis, as needed. The WA COR will issue a written technical directive identifying the locations and durations of the laboratory and/or wild/prescribed fire field studies, technical problem or methodology to be researched or investigated and the scope of the research. It is anticipated that a minimum of two wild/prescribed field studies will occur during

this performance period. The field campaigns will be conducted in the States of Kansas and Oregon with timing and exact siting TBD and issued through written technical directive. It is anticipated that up to three weeks of contractor support will be needed on-site during each field study.

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 and towing vehicle.

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 D-EMMD-AQB-008-QAPP-02) 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: 2-106

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number: 2

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 04/01/2017 To 03/31/2018

Comments:
Work plan due within 20 days of award

☐ 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 03/31/2018 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: 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: Mark Cranley
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-487-2351
FAX Number: 513-487-2109

Performance Statement of Work

Full WA Title: Computational Chemistry Studies of the Lifetimes of Early Generation Oxidized Atmospheric Species.

Short WA Title: Computational Studies of Atmospheric Species

(This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment # 1-106)

WA #: 106
Contract #: EP-C-15-008

WACOR: Surender Kaushik
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, 2018.

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)/NOX, HC/OH, or HC/NO3 systems.

BACKGROUND
Toxic compounds may either be emitted or produced in the atmosphere. The production and degradation rates for regulated species such as PM2.5, O3 and NOx 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 O3 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 lifetimes of organonitrates under high NOX conditions.

NOx is a central player in the atmospheric chemistry of urban environments. After the hydroxyl radical has initiated the oxidation of hydrocarbons, NOx readily reacts with the generated peroxy radicals. The main result of this sequence is the production of two prominent atmospheric pollutants: NO2 and O3. However, alternative pathways exist with the major one giving rise to organonitrates that sequester some of the NOx, at least temporarily. Uncertainties exist with regards to the lifetimes of organonitrates in the atmosphere and the degree to which these compounds sequester NOx. Consequently, the contractor shall perform high level quantum mechanical calculations on the oxidation of organonitrates with OH. Several pathways (OH addition and abstraction) will be considered using computationally efficient DFT methods (M062x density functional or one of the newer Minnesota functionals). The branching ratios of the dissociation of several alkoxy radicals generated by oxidized isoprene organonitrates will also be determined by mapping this part of the potential energy surface for prominent isomers.

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 NOx reactions of interest (for example multi-nitrate formation, OH addition and abstraction, alkoxy radical fragmentation – 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 present a summary of the results of the calculations in a couple of face-to-face meetings at the EPA campus in the Research Triangle Park.

Task 2. A computational investigation of the lifetimes of hydroperoxides under low NOx conditions.

In more rural settings, the lack of NOx does not impede oxidation although it changes the distribution of products generated. These pathways are important because they affect HOx 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 HOx 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. Recently, a new oxidation pathway has been proposed and preliminary calculations have been conducted to explore the gas phase oxidation of isoprene which leads to hydroperoxides. High resolution chemical ionization mass spectrometry (CIMS) data have also been collected on a series of chamber experiments involving isoprene and the hydroxyl radical.

In this task, the contractor shall conduct high level quantum chemistry calculations of new early generation isoprene oxidation pathways to rationalize the CIMS dataset. Stationary and transition states will be optimized (approximately 12) and the results will be compared with the more traditional pathways involving OH additions and intramolecular isomerizations. 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 direction 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 N2O5, 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 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 WACOR, the contractor shall also use the Aerodyne Aerosol Mass Spectrometer (AMS) to characterize the organic components of chamber aerosol during controlled irradiations. The 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 NOx conditions shall be prepared for the EPA WACOR to review by March 31st, 2018.

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 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: 2-107

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number 2

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 04/01/2017 To 03/31/2018

Comments:
Work plan due by 4/21/17

☐ 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										
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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 Gary Norris	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-1519
			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: Water Metals Analysis Operating Procedures and Field Sample Preparation

WA #: 2-107 WACOR: Gary Norris

Contract #: EP-C-15-008 Alternate WACOR: Jason Weinstein

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

SUMMARY OF OBJECTIVES

Develop Standard Operating Procedures (SOPs), sample containers, and Quality Assurance Project Plan information for the Wastewater Characterization and Mass Balance Evaluation of Coal Fired Generating Stations using Bromide/Iodide Additives Quality Assurance Project. In addition, conduct a literature review of water extraction methods for selenium.

BACKGROUND

The Sources and mass balance of bromide/iodide and inorganic species in coal-fired generating station wastewaters halide addition for enhanced mercury control research effort contributes to EPA Office of Research and Development Safe and Sustainable Water Resources Research Program (SSWR) Task 6.01C – Cost and Effectiveness of Water Treatment to Achieve Regulatory Compliance.

Coal fired generating stations are adding bromide or iodide additives to coal to meet the air pollution goals for the Mercury Air Toxics Standards (MATS) rule. For plants that use wet flue gas desulfurization (FGD) scrubbers, these additives increase the bromide or iodide concentrations in wastewater discharges. Elevated levels of bromide in public drinking water intakes contributes to trihalomethanes disinfection byproduct (DBP's) formation in finished drinking water which are associated with increased bladder cancer. While some plants are adding iodine to coal, the volume, types and possible effects of iodinated waste compounds have not been studied.

EPA ORD is conducting a study to identify and quantify these halide salt additives on coal fired power plant discharges. The study requires collecting surface water intake and wastewater samples at the generating stations, filtering and digesting samples, and analyzing the samples for anions and inorganic species. The wastewater contaminant data will be used to evaluate modeling approaches that are being developed to quantify the fate and transport of coal fired power plant contaminants. The QAPP for this effort is being developed by EPA, independent of this WA, and is titled "Wastewater Characterization and Mass Balance Evaluation of Coal Fired Generating Stations using Bromide/Iodide Additives."

SCOPE

Develop two SOPs for wastewater sampling covering two components of the project: cleaning sample containers and assessing contaminant levels, and filtering and digesting water samples. The contractor shall prepare containers for evaluation of the sample container blanks and field sampling. The contractor shall also filter and digest samples following the SOPs to provide information for the Measurements and Mass Balance Evaluation of Coal Fired Generating Stations using Bromide/Iodide Additives Quality Assurance Project Plan. In addition, the contractor shall conduct a literature review of water extraction methods for selenium since bromide addition to coal has been found to enhance selenium wastewater concentrations.

TECHNICAL APPROACH/OBJECTIVES

Contractor shall complete the following tasks under this WA:

1) The contractor shall develop a sample container cleaning and labeling SOP based on EPA SOP ECAB-132.0 Manual Collection of Hydraulic Fracturing Wastewater Samples and prepare 100 containers (250 ml) for evaluation of the sample container blanks and field sampling. The contractor shall weigh the containers following EPA SOP ECAB-139.0 Field Sampling Bottle Pre- and Post-Weighing. EPA will provide the contractor the ECAB SOPs. The contractor shall set-up the weighing system with a new EPA provided computer and include the computer information in the SOP. The contractor shall also clean 220 DigiPREP Jr. extraction tubes using the sample cleaning SOP. In addition, the contractor shall clean 12 grab sample cups, 12 one gallon sensor containers, 20 one liter sample containers, and 36 amber sample containers. The contractor shall generate labels for the sample containers and the WACOR will provide the sample naming convention and required format.

2) Develop method for filtering and digesting water samples collected in plastic sample bottles. The contractor shall develop a new EPA SOP for the filtration and digestion/extraction of coal fired power plant wastewater, river, and other samples provided under technical direction from the WACOR. The contractor shall develop the SOP for a 50ml DigiPREP Jr. block digester. The development of this new SOP will be an extension of the 1992 EPA SOP titled "METHOD 3005A ACID DIGESTION OF WATERS FOR TOTAL RECOVERABLE OR DISSOLVED METALS FOR ANALYSIS BY FLAA OR ICP SPECTROSCOPY" and it will be based on EPA METHOD 3005A ACID DIGESTION OF WATERS FOR TOTAL RECOVERABLE OR DISSOLVED METALS FOR ANALYSIS BY FLAA OR ICP SPECTROSCOPY (https://www.epa.gov/sites/production/files/2015-12/documents/3005a.pdf). Contractor shall procure materials and supplies to accomplish this task. The contractor shall install new pre-filters in the Milli-Q ultra-pure water system before cleaning sample containers and contractor shall procure extraction consumables (DigiPREP Jr. filter packs, and tubes).

3) The contractor shall filter and digest 12 samples using the SOP developed in task 2) and provide the samples to EPA for analysis. EPA will provide 6 water blank samples and 6 water unknown samples for this task via technical direction.

4) The contractor shall conduct a literature review on selenium water analysis solid phase extraction (SPE) methods compatible with HR-ICPMS and ICP-OES.

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

EPA shall furnish contractor a DigiPREP Jr. block digester for the SOP development. The contractor shall purchase consumables for the water system and extraction supplies for SOP development.

QUALITY ASSURANCE

The purpose of this WA is to create SOPs that will be part of the Measurements and Mass Balance Evaluation of Coal Fired Generating Stations using Bromide/Iodide Additives Quality Assurance Project Plan (QAPP).

DELIVERABLES

1. Sample Container Cleaning SOP
2. Sample Extraction SOP
3. Cleaned Sample Containers
4. Digested Samples
5. Selenium Extraction Literature Review.

SCHEDULE of DELIVERABLES

1. Sample Container Cleaning SOP – May 1, 2017
2. Cleaned Sample and Extraction Containers – June 16, 2017
3. Sample Extraction SOP – June 30, 2017
4. Digested Samples – July 28, 2017
5. Literature Review – September 1, 2017

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-111

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number 2

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 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17

☐ 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 03/31/2018 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 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 Mark Cranley	(Signature)	(Date)	Branch/Mail Code:
		Phone Number: 513-487-2351
		FAX Number: 513-487-2109

Performance Statement of Work

WA Title: NERL RTP VOC Laboratory Support for Canister and Sorbent Sampling Methodologies and TO Method Updates

WA Short Title: NERL RTP VOC Lab Support and TO Method Updates

WA #: 2-111 WACOR: Karen Oliver

Contract #: EP-C-15-008 Alternate WACOR: Don Whitaker

The work assignment is a continuation of work under WAs 1-111 and 1-112.

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, 2018.

SUMMARY OF OBJECTIVES

This work assignment provides laboratory and data reduction/analysis support for the NERL RTP VOC laboratory efforts associated with volatile organic compound (VOCs) analyses. The VOC laboratory is responsible for conducting high-visibility research projects using whole air canister sampling methods employing preconcentration/GC-MS analytical techniques and sorbent tube sampling methods employing thermal desorption/GC-MS analytical techniques as detailed in EPA SOPs.

Additionally, 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. Contractor assistance is needed in the areas of 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 technical editing and assistance in preparing the final draft updates of the methods.

BACKGROUND

The NERL RTP VOC laboratory provides analytical support and methods development activities for a variety of high-visibility ORD and OAQPS research efforts. Following are examples of recent and current research activities that require contractor support.

Under ACE Task EM 1.5, research efforts have included optimization of the determination of acrolein and associated VOCs in canisters using modified EPA Compendium Method TO-15 techniques.

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. Current ORD research efforts have included 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. Potential new activities include supporting research efforts in Kentucky and Maine.

Additional background information and SOPs are presented in the following EPA-approved QAPPs that are either current or historical for this WA:

- QAPP titled "ACE Task 135 – Improved Method for Measuring Acrolein" (developed under ACE Task 135 which is now ACE Task EM 1.5),
- QAPP titled "Collaborative Evaluation of a Low-Cost Volatile Organic Compound Passive Sampling Method and Laboratory Intercomparison" (developed under ACE Task 60 which is now ACE Task EM 1.2),
- "Philadelphia Passive Sampler Method Study. EPA Region 3 Energy RARE Project", QLOG No. A-18508, QTRAK No. 13010, and
- "Quality Assurance Project Plan, Tire Crumb Research Sample Analysis."

In addition, QAPPs for any new studies will be provided to the contractor.

EPA's Air, Climate, and Energy (ACE) Program 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. Contractor support is needed to conduct applicable research and provide both content and technical editing for the updated TO Methods.

SCOPE

For the NERL RTP VOC laboratory support activities for canister and sorbent sampling methodologies, the contractor shall provide technical support for the activities described in the Background and Summary of Objectives.

The Contractor shall conduct laboratory work which includes the following VOC laboratory activities: 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 (7200 series)/Agilent GC-MS systems for the determination of VOCs collected in canisters; and operating the VOC preconcentration (Entech 7200)/GC-FID (HP/Agilent) system in the VOC laboratory. The Contractor shall operate the Markes TD Autosampler/Unity/CIA Advantage/Agilent 7890 GC/Almsco Bench TOF Select MS system. In addition, the contractor shall have knowledge of the software packages that are installed on the Markes TD/GC-MS TOF system which requires an understanding of the underlying programming features of the instrument software and reporting packages.

Contractor support is needed to

- condition Carbopack X and other types of diffusive sampling tubes,
- prepare calibration tube standards using the exposure chamber and active loading system,
- monitor exposure chamber VOC concentrations using the Entech/GC-FID system,
- clean canisters,
- prepare and ship sampling tubes and/or canisters for use in field studies,
- prepare calibration standards of various gas mixtures in canisters,
- operate instrumentation (PerkinElmer thermal desorption /Agilent GC-MS systems, Entech 7200/GC-MS system, and Markes Unity/Almsco GC-TOF system) for tube and canister sample analyses,
- conduct various research experiments (reverse diffusion, temperature and humidity tests, etc.) for validation of target compounds to be collected on sorbent tubes,
- develop/optimize methods and analyze samples collected on tubes using thermal desorption/GC-MS techniques,
- analyze canister samples,
- process/summarize canister and sorbent tube sample data and related QA data, and
- prepare and revise SOPs as necessary, prepare summary tables of data generated during the course of the work, and review/edit journal articles.

EPA VOC Laboratory SEE staff support the routine activities listed above in the first six bullets (tube conditioning, canister cleaning, preparing calibration standards,

and preparing and shipping samples to the field); however, occasional contractor support will be needed to supplement these activities when SEE staff are not available. The contractor will need experience in handling Carbopack X tubes (conditioning tubes and preparing them for shipment) and using the exposure chamber for preparing calibration standards diffusively on Carbopack X tubes.

The majority of VOC laboratory activities to be supported by the contractor under this WA will be those in the last six bullets above. These activities will require extensive knowledge and experience in developing and optimizing methods for determination of VOCs in ambient air and includes the use of thermal desorption, VOC preconcentration, GC-MS, and GC-MS Time of Flight (TOF) analytical techniques.

Also, 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. 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 refining 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 highly-skilled technical, administrative, and laboratory support on an ongoing basis. The Contractor shall provide technical writing and editorial assistance for developing SOPs, reports, presentations, and journal articles. The contractor shall support this task and provide relevant feedback on TO Method updates, technical writing and editorial support for the refinement of the documentation process by which TO Methods are being updated or new TO methods are being developed by EPA.

In addition, the contractor shall 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. The required technical and administrative support activities are listed below under "Technical Approach/Objectives."

TECHNICAL APPROACH/OBJECTIVES

Laboratory Activities

1. During periods of active laboratory analyses, the Contractor shall support 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 activities of the monitoring system associated with the canister/tube standards loading system (Entech/GC-FID system). In addition, the Contractor shall support methods development/optimization and sample analysis/data reduction of canister and/or sorbent tubes using the RTP VOC laboratory's PerkinElmer automated thermal desorption (ATD)/Agilent GC-MS systems, Entech 7200/GC-MS system, and the new Markes Unity/Almsco GC-TOF system. The Contractor shall maintain spreadsheets tracking QA activities and tracking sorbent tube usage during field studies and shall 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 ten 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 as needed.

- The Contractor shall operate the EPA Entech VOC Concentrator/GC-FID system in the exposure chamber laboratory to monitor chamber contents during tube exposures as needed. 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.

- The Contractor shall conduct various research experiments (reverse diffusion, temperature and humidity tests, etc.) for validation of target compounds to be collected on sorbent tubes.

- The Contractor shall develop/optimize methods and analyze samples collected on sorbent tubes using thermal desorption/GC-MS and GC-MS TOF analytical techniques and samples in canisters using VOC preconcentration/GC-MS and GC-MS TOF analytical techniques.

- The Contractor shall maintain spreadsheets/graphs of QA activities such as control charting of internal and external standards.

2. The Contractor shall assist in the development and revision of SOPs as needed for laboratory instrumentation and methods. 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.

TO Method Update Activities

4. TO Method Update Support Activities

   a. The contractor shall support the EPA TO Methods Update program in refining the update process that was supported previously under WA 1-112. The contractor shall convert current TO methods to Word editable format as needed 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 content editing, technical editing and graphics support (if applicable) for work performed under this work assignment, as may be necessary or incidental. 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.

5. 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. 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.

QUALITY ASSURANCE

The Contractor shall use the existing EPA-approved QAPPs listed in the Background section above and provide updates to 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.

As the TO Method Update portion of the 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 prepare an SOP for the generation of canister calibration standards using the Entech Static Diluter in laboratory D277A. An initial draft version of the SOP is due 45 days after WA approval, and the final version of the SOP is due 30 days later.

• The Contractor shall prepare an SOP for the operation of the Markes thermal desorber/GC-TOF system for determination of VOCs in air samples collected in canisters. An initial draft version of the SOP is due on July 31, 2017, and the final version of the SOP is due two months later.

• 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, 2017.

• The Contractor shall prepare a brief letter report containing the tracking spreadsheets that were prepared for this project and documenting any additional supporting information on QA results, TO Method update activities, and on any other topic that helps in interpretation of the results of the activities that were conducted/completed during the period of performance. This report is due at the end of the period of performance.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-111

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-008	04/01/2015 To 03/31/2018 Base Option Period Number 2	NERL VOC Lab Spt

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 04/01/2017 To 03/31/2018

Comments:
This is an amendment to the original WA and new text is highlighted in the Amended PWS in yellow. All other terms and conditions remain unchanged.

☐ 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 Karen Oliver	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-2337 FAX Number:
Project Officer Name Melissa Revely-Wilson	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-0207 FAX Number:
Other Agency Official Name Keith Pfeffer	(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: NERL RTP VOC Laboratory Support for Canister and Sorbent Sampling Methodologies and TO Method Updates

WA Short Title: NERL RTP VOC Lab Support and TO Method Updates

WA #: 2-111 WACOR: Karen Oliver

Contract #: EP-C-15-008 Alternate WACOR: Don Whitaker

The work assignment is a continuation of work under WAs 1-111 and 1-112.

This is an amendment to the original WA and new text is highlighted in yellow font.

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, 2018.

SUMMARY OF OBJECTIVES

This work assignment provides laboratory and data reduction/analysis support for the NERL RTP VOC laboratory efforts associated with volatile organic compound (VOCs) analyses. The VOC laboratory is responsible for conducting high-visibility research projects using whole air canister sampling methods employing preconcentration/GC-MS analytical techniques and sorbent tube sampling methods employing thermal desorption/GC-MS analytical techniques as detailed in EPA SOPs.

Additionally, 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. Contractor assistance is needed in the areas of 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 technical editing and assistance in preparing the final draft updates of the methods.

BACKGROUND

The NERL RTP VOC laboratory provides analytical support and methods development activities for a variety of high-visibility ORD and OAQPS research efforts. Following are examples of recent and current research activities that require contractor support.

Under ACE Task EM 1.5, research efforts have included optimization of the determination of acrolein and associated VOCs in canisters using modified EPA Compendium Method TO-15 techniques.

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. Current ORD research efforts have included 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. Potential new activities include supporting research efforts in Kentucky and Maine.

Additional background information and SOPs are presented in the following EPA-approved QAPPs that are either current or historical for this WA:

- QAPP titled "ACE Task 135 – Improved Method for Measuring Acrolein" (developed under ACE Task 135 which is now ACE Task EM 1.5),
- "Rubbertown Next Generation Emission Measurement Demonstration Project", QLOG No. G-APPCD-0021097-QP-1-2, QTRAK No. 15010, and
- "Quality Assurance Project Plan, Tire Crumb Research Study Sampling and Analyses, DC# D-SED-IEMB-006-QAPP-02."

In addition, QAPPs for any new studies will be provided to the contractor.

EPA's Air, Climate, and Energy (ACE) Program 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. Contractor support is needed to conduct applicable research and provide both content and technical editing for the updated TO Methods.

SCOPE

For the NERL RTP VOC laboratory support activities for canister and sorbent sampling methodologies, the contractor shall provide technical support for the activities described in the Background and Summary of Objectives.

The Contractor shall conduct laboratory work which includes the following VOC laboratory activities: 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 (7200 series)/Agilent GC-MS systems for the determination of VOCs collected in canisters; and operating the VOC preconcentration (Entech 7200)/GC-FID (HP/Agilent) system in the VOC laboratory. The Contractor shall operate the Markes TD Autosampler/Unity/CIA Advantage/Agilent 7890 GC/Almsco Bench TOF Select MS system. In addition, the contractor shall have knowledge of the software packages that are installed on the Markes TD/GC-MS TOF system which requires an understanding of the underlying programming features of the instrument software and reporting packages.

Contractor support is needed to

- condition Carbopack X and other types of diffusive sampling tubes,
- prepare calibration tube standards using the exposure chamber and active loading system,
- monitor exposure chamber VOC concentrations using the Entech/GC-FID system,
- clean canisters,
- prepare and ship sampling tubes and/or canisters for use in field studies,
- prepare calibration standards of various gas mixtures in canisters,
- operate instrumentation (PerkinElmer thermal desorption /Agilent GC-MS systems, Entech 7200/GC-MS system, and Markes Unity/Almsco GC-TOF system) for tube and canister sample analyses,
- conduct various research experiments (reverse diffusion, temperature and humidity tests, etc.) for validation of target compounds to be collected on sorbent tubes,
- develop/optimize methods and analyze samples collected on tubes using thermal desorption/GC-MS techniques,
- analyze canister samples,
- process/summarize canister and sorbent tube sample data and related QA data, and
- prepare and revise SOPs as necessary, prepare summary tables of data generated during the course of the work, and review/edit journal articles,
- assist with the startup of the Louisville/Rubbertown study that is expected to begin in mid-September, prepare sampling media for shipment (including blanking tubes) during the course of the study (September through March), and analyze and reduce data for approximately 300 samples (excluding

QA/QC samples) on either the ATD 650/GC-MS or Markes TD/GC-TOF MS systems,

- support the evaluation efforts for the new exposure chamber in laboratory D-260 as detailed below,
- support the evaluation efforts for the multisorbent diffusive monitoring (MSDM) tubes from PerkinElmer which will be evaluated in side-by-side comparisons of approximately 35 samples sited with Supelco FLM tubes, potentially in the Louisville/Rubbertown study later in the year, of which a subset of 10 samples will be sent to the HSL in the UK for analysis as a QA check, and
- support the exposure study efforts that were recently approved for the tire crumb research study (TCRS) which includes the evaluation of Radiello samplers (determination of uptake rates, evaluation of precision), methods development for determination of VOCs collected on Radiello cartridges and analysis of as many as 75 samples (including QA/QC samples).

EPA VOC Laboratory SEE staff support the routine activities listed above in the first six bullets (tube conditioning, canister cleaning, preparing calibration standards, and preparing and shipping samples to the field); however, occasional contractor support will be needed to supplement these activities when SEE staff are not available. The contractor will need experience in handling Carbopack X tubes (conditioning tubes and preparing them for shipment) and using the exposure chamber for preparing calibration standards diffusively on Carbopack X tubes.

The majority of VOC laboratory activities to be supported by the contractor under this WA will be those in the last ten bullets above. These activities will require extensive knowledge and experience in developing and optimizing methods for determination of VOCs in ambient air and includes the use of thermal desorption, VOC preconcentration, GC-MS, and GC-MS Time of Flight (TOF) analytical techniques.

Also, 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. 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 refining 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 highly-skilled technical, administrative, and laboratory support on an ongoing basis. The Contractor shall provide technical writing and editorial assistance for developing SOPs, reports, presentations, and journal articles. The contractor shall support this task and provide relevant feedback on TO Method updates, technical writing and editorial support for the refinement of the documentation process by which TO Methods are being updated or new TO methods are being developed by EPA.

In addition, the contractor shall 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. The required technical and administrative support activities are listed below under "Technical Approach/Objectives."

TECHNICAL APPROACH/OBJECTIVES

Laboratory Activities

1. During periods of active laboratory analyses, the Contractor shall support 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 activities of the monitoring system associated with the canister/tube standards loading system (Entech/GC-FID system). In addition, the Contractor shall support methods development/optimization and sample analysis/data reduction of canister and/or sorbent tubes using the RTP VOC laboratory's PerkinElmer automated thermal desorption (ATD)/Agilent GC-MS systems, Entech 7200/GC-MS system, and the new Markes Unity/Almsco GC-

TOF system. The Contractor shall maintain spreadsheets tracking QA activities and tracking sorbent tube usage during field studies and shall 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 fifteen 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 as needed.

- The Contractor shall operate the EPA Entech VOC Concentrator/GC-FID system in the exposure chamber laboratory to monitor chamber contents during tube exposures as needed. 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 operate the Entech/GC-FID system in support of the evaluations of the Radiello samplers and the evaluation of the climate-controlled exposure chamber as detailed below.

- The Contractor shall prepare tubes for shipment to the field based on schedules to be provided by EPA. Tubes will be shipped for both the TCRS and for the Louisville/Rubbertown study.

- 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: the 25 component DEARS compound list that is a subset of the EPA Compendium Method TO-14 compound list along with *cis*- and *trans*-2-butene, MIBK and benzothiazole.

- The Contractor shall conduct various research experiments (reverse diffusion, temperature and humidity tests, etc.) for validation of target compounds to be collected on sorbent tubes. These experiments will include the determination of uptake rates for Carbopack X Radiello cartridges to be used in TCRS efforts and determination of the precision of measurements generated with the Radiello sample collection method.

- The Contractor shall develop/optimize methods and analyze samples collected on sorbent tubes using thermal desorption/GC-MS and GC-MS TOF analytical techniques and samples in canisters using VOC

preconcentration/GC-MS and GC-MS TOF analytical techniques. The optimization of methods will include those for analysis of Radiello samplers and MSDM tubes.

- The Contractor shall maintain spreadsheets/graphs of QA activities such as control charting of internal and external standards.

2. The Contractor shall assist in the development and revision of SOPs as needed for laboratory instrumentation and methods. The Contractor shall also provide technical editorial review of the SOPs. SOPs will include those for the TCRS efforts (Radiellos and active sample collection) and the climate-controlled exposure chamber.

3. The contractor shall assist in the evaluation of the climate-controlled exposure chamber experiments that include the following:

   - Evaluate chamber data logging and retrieval system for temperature and humidity measurement
   - Conduct background/cleanliness tests of the new climate-controlled exposure chamber
   - Determine necessary equilibration times of TO-14 calibration mixtures delivered to the exposure system (1 to 6 hour tests)
   - Evaluate the heating and cooling features of the chamber with respect to how well-controlled the temperatures are and how various high and low temperatures affect VOC recoveries
   - Revise the SOP for the exposure chamber as appropriate
   - Expose Carbopack X sorbent tubes and/or Radiello Carbopack X sorbent cartridges to various concentrations of VOCs (TO-14) to assist in evaluating performance under conditions of varying temperature/humidity and to determine uptake rates for Radiello Carbopack X cartridges
   - Monitor the exposure chamber contents using the Entech/Agilent system when VOC sensors are being tested in the chamber
   - Maintain laboratory notebook and document the results of experiments in spreadsheets and technical reports.

Publication Activities

4. 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.

TO Method Update Activities

5. TO Method Update Support Activities

   a. The contractor shall support the EPA TO Methods Update program in refining the update process that was supported previously under WA 1-112. The contractor shall convert current TO methods to Word editable format as needed 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 content editing, technical editing and graphics support (if applicable) for work performed under this work assignment, as may be necessary or incidental. 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.

5. 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. 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.

QUALITY ASSURANCE

The Contractor shall use the existing EPA-approved QAPPs listed in the Background section above and provide updates to 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.

As the TO Method Update portion of the 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 prepare an SOP for the generation of canister calibration standards using the Entech Static Diluter in laboratory D277A. An initial draft version of the SOP is due 45 days after WA approval, and the final version of the SOP is due 30 days later.

- The Contractor shall prepare an SOP for the operation of the Markes thermal desorber/GC-TOF system for determination of VOCs in air samples collected in canisters. An initial draft version of the SOP is due on July 31, 2017, and the final version of the SOP is due two months later.

- 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, 2017.

- The Contractor shall prepare a brief letter report containing the tracking spreadsheets that were prepared for this project and documenting any additional supporting information on QA results, TO Method update activities, and on any other topic that helps in interpretation of the results of the activities that were conducted/completed during the period of performance. This report is due at the end of the period of performance.

- The Contractor shall revise the TCRS Radiello SOP, TCRS Active Loading SOP, and Climate-Controlled Exposure Chamber SOP to reflect method updates. The revised SOPs are due on December 15, 2017.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-113

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number 2

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 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17

☐ 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 03/31/2018 — 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 Michael Lewandowski	(Signature)	(Date)	Branch/Mail Code:
		Phone Number: 919-541-9421
		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

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

(This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment # 1-113)

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, 2018.

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 chromatography, and Aerosol Mass Spectrometry 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 option period, 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 compound identifications were then applied to field study samples to estimate the contribution of SOA from anthropogenic and biogenic precursors.

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 may 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 aerosol properties (e.g., particle size, composition, and/or optical properties) 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 and/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 smog chamber, ancillary equipment, and the AMS system), 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 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 Aerosol Mass Spectrometer data to characterize the inorganic and organic components of chamber aerosol generated 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.

The contractor shall perform additional offline analyses, as required, of gas and aerosol samples produced using the smog chamber system described in Task 1. Potential analysis methods include: peroxide content analysis using a derivatization and UV-visible spectroscopic technique, measurements of the N_2O_5 concentrations using an NO titration technique employing a heated-line inlet system in conjunction with a standard NO_X analyzer, coupled DNPH derivatization and HPLC analysis of carbonyl compounds, and water-soluble organic carbon analysis of filter extracts.

Task 3. Analysis of $PM_{2.5}$ Field Samples
In the winter of 2017, EPA participated in the Utah Wintertime PM field study at a site in Logan, Utah. The contractor shall complete the analysis of remaining samples and data collected during these studies, including analysis of collected AMS data. Reporting of data to appropriate study-specific databases will be required. Offline analysis of additional filter samples may also be performed, time permitting. Additionally, short-term field sampling may be required at a local site (on-campus or Duke Forest, NC) during the summer of 2017.

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) 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 as appropriate, (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.

4) 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 along with QAPP updates (if necessary) within one month of the changes.

7) A manuscript describing AMS results addressing composition-driven volatility of chamber-generated secondary organic aerosols shall be submitted to an appropriate journal for peer review by May 2017. Formatted source data from this manuscript shall also be provided in accordance with EPA QA requirements.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-113

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number: 2

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 04/01/2017 To 03/31/2018

Comments:
The purpose of this amendment is to revise the PWS. Please submit a revised technical plan and cost estimate within 20 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										
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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: Michael Lewandowski	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-9421
			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 – changes in bold)

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Short WA Title: Smog Chamber Studies of Atmospheric Chemistry

(This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment # 1-113)

WA #: 113
Contract #: EP-C-15-008

WACOR: Michael Lewandowski
Alternate WACOR: Tad Kleindienst

PERIOD OF PERFORMANCE
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WA SPECIFIC EQUIPMENT

Research performed under this Work Assignment will make use of existing EPA smog chambers, gas monitors, 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

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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) 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 as appropriate, (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.

4) 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 along with QAPP updates (if necessary) within one month of the changes.

7) A manuscript describing AMS results addressing composition-driven volatility of chamber-generated secondary organic aerosols shall be submitted to an appropriate journal for peer review by May 2017. Formatted source data from this manuscript shall also be provided in accordance with EPA QA requirements.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-113

☐ Other ☒ Amendment Number: 000002

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 2	Smog Chamber Studi

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 04/01/2017 To 03/31/2018

Comments:
See attached PWS - Amendment 000002 changes are highlighted.

☐ 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: Michael Lewandowski	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-9421 FAX Number:
Project Officer Name: Melissa Revely-Wilson	(Signature)	(Date)	Branch/Mail Code: Phone Number: 919-541-0207 FAX Number:
Other Agency Official Name: Keith Pfeffer	(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 2-113 Amendment 2

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, 2018.

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 chromatography, and Aerosol Mass Spectrometry 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 option period, 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 compound identifications were then applied to field study samples to estimate the contribution of SOA from anthropogenic and biogenic precursors.

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 may 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 aerosol properties (e.g., particle size, composition, and/or optical properties) 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 and/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 smog chamber, ancillary equipment, and the AMS system), 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.). **Appropriate shop support for routine maintenance, repair, and calibration of typical chamber systems and instrumentation shall be included.** 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 35 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 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 Aerosol Mass Spectrometer data to characterize the inorganic and organic components of chamber aerosol generated 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.

The contractor shall perform additional offline analyses, as required, of gas and aerosol samples produced using the smog chamber system described in Task 1. Potential analysis methods include: peroxide content analysis using a derivatization and UV-visible spectroscopic technique, measurements of the N_2O_5 concentrations using an NO titration technique employing a heated-line inlet system in conjunction with a standard NO_X analyzer, coupled DNPH derivatization and HPLC analysis of carbonyl compounds, and water-soluble organic carbon analysis of filter extracts.

The contractor shall also provide modified TO-17 analysis of lower-volatility (SVOC) compounds via sorbent tubes for approximately 10 chamber experiments. Each experiment shall be expected to include a background sample and multiple hydrocarbon measurements, including pre- and post-irradiation hydrocarbon measurements.

Task 3. Analysis of $PM_{2.5}$ Field Samples
In the winter of 2017, EPA participated in the Utah Wintertime PM field study at a site in Logan, Utah. The contractor shall complete the analysis of remaining samples and data collected during these studies, including analysis of collected AMS data. Reporting of data to appropriate study-specific databases will be required. Offline analysis of additional filter samples may also be performed, time permitting. Additionally, short-term field sampling (approximately 2-4 weeks) may be required at a local site (on-campus or Duke Forest, NC) during the fall of 2017. **The contractor shall be prepared to provide technical oversight and maintenance support for the AMS instrumentation for the duration of a field deployment.**

The contractor shall also provide for radiocarbon (^{14}C) analysis of up to 100 filter samples, including blanks and standards. Samples shall be analyzed using previously developed methods and QA procedures.

WA SPECIFIC EQUIPMENT

Research performed under this Work Assignment will make use of existing EPA smog chambers, gas monitors, 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) 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 as appropriate, (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.

4) 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 along with QAPP updates (if necessary) within one month of the changes.

7) A manuscript describing AMS results addressing composition-driven volatility of chamber-generated secondary organic aerosols shall be submitted to an appropriate journal for peer review by May 2017. Formatted source data from this manuscript shall also be provided in accordance with EPA QA requirements.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-113

☐ Other ☒ Amendment Number: 000003

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number: 2

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 04/01/2017 To 03/31/2018

Comments:
The purpose of this modification is to revise the PWS. A revised technical memo and cost estimate are due within 20 calendar 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										
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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: Michael Lewandowski
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-9421
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: Keith Pfeffer
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

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

(This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment # 1-113)

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, 2018.

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 chromatography, and Aerosol Mass Spectrometry 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.

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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).

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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 may 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 aerosol properties (e.g., particle size, composition, and/or optical properties) 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 and/or in the Mobile Chamber system.

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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 smog chamber, ancillary equipment, and the AMS system), 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.). **Appropriate shop support for routine maintenance, repair, and calibration of typical chamber systems and instrumentation shall be included.** 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 35 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 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 Aerosol Mass Spectrometer data to characterize the inorganic and organic components of chamber aerosol generated 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.

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Task 3. Analysis of $PM_{2.5}$ Field Samples
In the winter of 2017, EPA participated in the Utah Wintertime PM field study at a site in Logan, Utah. The contractor shall complete the analysis of remaining samples and data collected during these studies, including analysis of collected AMS data. Reporting of data to appropriate study-specific databases will be required. ~~Offline analysis of additional filter samples may also be performed, time permitting. Additionally, short-term field sampling (approximately 2-4 weeks) may be required at a local site (on-campus or Duke Forest, NC) during the fall of 2017. The contractor should be prepared to provide technical oversight and maintenance support for the AMS instrumentation for the duration of a field deployment.~~

The contractor shall also provide for radiocarbon (^{14}C) analysis of up to 100 filter samples, including blanks and standards. Samples shall be analyzed using previously developed methods and QA procedures.

WA SPECIFIC EQUIPMENT

Research performed under this Work Assignment will make use of existing EPA smog chambers, gas monitors, 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) 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 as appropriate, (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.

4) 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 along with QAPP updates (if necessary) within one month of the changes.

7) A manuscript describing AMS results addressing composition-driven volatility of chamber-generated secondary organic aerosols shall be submitted to an appropriate journal for peer review by May 2017. Formatted source data from this manuscript shall also be provided in accordance with EPA QA requirements.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-115

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number 2

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 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17

☐ 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										
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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 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 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 #:2-115 WACOR: Ron Williams

Contract #: EP-C-15-008 Alternate WACOR: Andrea Clements

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from April 1, 2017 through March 31, 2018.

SUMMARY OF OBJECTIVES

This work assignment shall provide field and/or laboratory technical support involving the evaluation of Next Generation Air Monitor (NGAM) technologies. It is primarily a follow-on activity to those previously performed under WA 1-115. 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, 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 (https://www.epa.gov/air-sensor-toolbox) 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 per technical direction shall involve Contractor evaluation/summarization of NGAM-produced test data and sensor pod maintenance.

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 follow-on activities from the original effort (WA 0-115 and WA 1-115) 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 90 days for any sensor type, some sensor types may take longer. The estimated nominal length of deployment for any sensor shall be 30 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 2017; summer 2017; fall 2017; winter 2018) 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. The Contractor shall include purchase of a maximum of ten (10) NGMAs commercially available for testing identified. 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 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 and already in position at the AIRS 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 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, 2017 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. No capital equipment (devices > $2500 each) shall be acquired under this WA. The WA COR shall approve the selection of all sensors associated with this task. All Contractor sensor testing 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 all 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) shall be made available to the Contractor and used if needed. 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 be expected when any field efforts are occurring. Data format for these recovered data sets provided to the WA COR shall meet WA COR approved formats as previously defined in the 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 to complete data summarization. The WA COR will finalize all report(s) provided by the Contractor to meet EPA peer review standards. A draft report prepared by the Contractor during WA 1-115 (UN Sensor Pod) shall be finalized in the current WA.

Sensor evaluations being conducted by two external citizen groups (Clean Air Carolina, Eastern Band of the Cherokee Indians) shall result in databases being created by these two groups. The Contractor shall perform QA review of these data and provide technical support to the WA COR in their summarization using a previously established macro developed in WA 1-115. The Contractor shall under technical direction, further refine the aforementioned macro.

Task #3. Sensor Pod Maintenance

The Contractor shall have familiarity with sensor pods currently deployed in Puerto Rico, Southern California, and Memphis, Tennessee. In the event said pods require some form of general maintenance or technical troubleshooting, the total component costs will not exceed $3,000 and technical labor for repair/refurbishment or other efforts associated with this task will not exceed 80 hours. All repair/refurbishment activities shall occur through technical

direction. One deliverable associated with this task is a WA COR approved research operating protocol fully defining the CitySpace pods previously developed under WA 1-039. The WA COR shall provide the Contractor with an example format for the operating protocol to use as a guide.

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 in support of this work no later than July 1, 2017. 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 that describes sensor operating procedures a minimum of 30 days prior to planned deployment date.

Deliverable 1.3. The Contractor shall deploy all NGAMs associated with field site evaluations by December 1, 2017 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 at least 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. The Contractor shall update any seminal report with amendments to include sensors tested later in the work assignment

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 2017, August 30th 2017, and November 30th 2017). A WA COR approved final report shall be provided by March 31, 2018.

Deliverable 3.1. The Contractor shall provide sensor pod technical support on an as-needed basis during the April 1 2017 through March 30, 2018 time-period.

Deliverable 3.2 The Contractor shall deliver an approved research operating procedure using EPA formatting requirements concerning the operating procedures for the CitySpace sensor pods by June 15, 2017.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-115

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number 2

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 04/01/2017 To 03/31/2018

Comments:
The purpose of this amendment is to revise the PWS. An updated technical memo and revised cost estimate are due within 20 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: 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 #1 – Sept 2017

WA Title: Next Generation Air Monitoring Technical Support

WA #:2-115 WACOR: Andrea Clements

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 April 1, 2017 through March 31, 2018. **This amendment does not change the period of performance.**

SUMMARY OF OBJECTIVES

Brief Restatement: 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). The Contractor shall conduct efforts related to evaluation of low cost sensors at the existing AIRS platforms on the EPA campus. 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. **This amendment does not change the summary of objectives of this WA.**

BACKGROUND

Brief Restatement: 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 and WA 1-115) in support of previously defined research plans. **This amendment does not change the background of this WA.**

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 90 days for any sensor type unless amended by technical direction. For estimation purposes, the nominal length of deployment for any sensor shall be 30 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 2017; summer 2017; fall 2017; winter 2018) 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 $20,000 with a maximum of ten (10) commercially available products for testing identified. 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.

All aspects of this scope of work remain valid. This amendment seeks to allow for the purchase of the Vaisala AQT 420 multi-pollutant sensor. This additional sensor will be the 8th sensor identified for this evaluation period.

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 and already in position at the AIRS 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, 2017 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 $20,000 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 testing 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 all 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 and used if needed. 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 when any field efforts are occurring. Data format for these recovered data sets provided to the WA COR shall meet WA COR approved formats as previously defined in the 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 1 details remain valid. This amendment will require the purchase of a new sensor - Vaisala AQT 420. The purchase will be initiated within 30 days of the work plan amendment approval. This will ensure the Contractor shall be able to acquire and deploy the sensor for a minimum of 30 days deployment at the AIRS platform.

Task #2 Data summarization

Brief Summary: The Contractor shall maintain electronic records of raw, validated, and processed sensor data associated with laboratory and field episodes. The Contractor shall develop technical report(s) summarizing the findings.

A draft report prepared by the Contractor during WA 1-115 (UN Sensor Pod) shall be finalized.

The contractor shall QA review data from the sensor evaluations being conducted by two external citizen groups (Clean Air Carolina, Eastern Band of the Cherokee Indians and provide technical support to the WA COR in their summarization using a previously established macro developed in WA 1-115.

The Contractor shall under technical direction, further refine the aforementioned macro to meet WA COR need.

This amendment does not change any aspect of Task #2.

Task #3. Sensor Pod Maintenance

Brief Summary: The Contractor has a high degree of familiarity of sensor pods currently deployed in Puerto Rico, Southern California, and Memphis, Tennessee. The Contractor shall provide general maintenance, technical troubleshooting, and repair and refurbishment. All repair/refurbishment activities shall occur through technical direction.

This amendment does not change any aspect of Task #3.

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.

This amendment does not change the applicable quality assurance documents listed here.

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 July 1, 2017. 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 planned deployment date.

Deliverable 1.3. The Contractor shall deploy all NGAMs associated with field site evaluations by December 1, 2017 to ensure a minimum of 30 day collocation versus reference monitors.

NEW - Deliverable 1.4. The Contractor shall procure three copies of the Vaisala AQT 420 multi-pollutant sensor within 30 days of the Work Plan Amendment and deploy the sensors for field evaluations within 60 days of Work Plan Amendment to yield a minimum collocation period of 30 days.

Task #2 EPA- Data Summarization

This amendment does not change Task #2 Deliverables

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. The Contractor shall update any seminal report with amendments to include sensors tested later in the work assignment

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 2017, August 30th 2017, and November 30th 2017). A WA COR approved final report shall be provided by March 31, 2018.

Task #3 EPA- Sensor Pod Maintenance

This amendment does not change Task #3 Deliverables

Deliverable 3.1. The Contractor shall provide sensor pod technical support on an as-needed basis during the April 1 2017 through March 30, 2018 time period.

Deliverable 3.2 The Contractor shall deliver an approved research operating procedure of EPA formatting requirements concerning the CitySpace sensor pods by June 15, 2017.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-119

☐ Other ☐ Amendment Number:

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 2	Fluid Modeling Facility Wind T

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: 1.2, 1.8, 2.0 (sections A, D, E, F, G), 3.0, 6.0

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

Period of Performance: From 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17

☐ 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 03/31/2018 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 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 #: 2-119 WACOR: David Heist

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

NOTE: This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment #1-119.

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

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 and 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 contractor shall design a measurement scheme to investigate the edge effects of roadside barriers when used in conjunction with line sources. These barriers shall include solid and porous barriers of three different heights and shall be located at three distances from the center of the roadway ranging from 18 m to 36m (full scale equivalent).

The contractor shall 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 with approximately 15 profiles for each case.

The contractor shall also design and execute a measurement scheme to characterize the building downwash phenomena when two buildings are present. The contractor shall use two buildings of equal size and shall create four cases to examine. Specifically, the contract shall examine the effective building concept used in dispersion modeling to account for the presence of multiple buildings.

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: 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.

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

None.

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, 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 21 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: 3/31/2018

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-119

☐ 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 2	WIND TUNNEL

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 04/01/2017 To 03/31/2018

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 03/31/2018 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 David Heist	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-1199 FAX Number:
Project Officer Name Melissa Revely-Wilson	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-0207 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: Fluid Modeling Facility Wind Tunnel Studies

WA #: 2-119 WACOR: David Heist

Contract #: EP-C-15-008 Alternate WACOR: Shawn Roselle

NOTE: This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment #1-119.

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

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 and 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 contractor shall design a measurement scheme to investigate the edge effects of roadside barriers when used in conjunction with a line sources. ~~These barriers shall include solid and porous barriers of three different heights and shall be located at three distances from the center of the roadway ranging from 18 m to 36m (full scale equivalent).~~

The contractor shall design and test a line-segment source to be used in the experiments. The barriers shall be equivalent in height to a 6 m full-scale noise barrier and equal in length to the line-segment source. The barriers shall be located at varying distances from the line segment source (i.e., the simulated travel lane of the roadway), and located 1) so the barrier is parallel and directly downwind of the source, and 2) is parallel but shift one source length laterally. The above test shall be conducted with the roadway perpendicular and at 45 degrees to the approach wind. Using these configurations, the contractor shall 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 with approximately 15 profiles for each case.

The contractor shall also design and execute a measurement scheme to characterize the building downwash phenomena when two buildings are present. The contractor shall use two buildings of equal size and shall create four cases to examine. Specifically, the contract shall examine the effective building concept used in dispersion modeling to account for the presence of multiple buildings.

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: 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 3: The contractor shall document recently proposed changes to AERMOD model to improve the building downwash algorithms performance against the wind tunnel data described in Perry et al (Atmospheric Environment,142: 286-295). The proposed changes will be supplied by the WACOR in the form of FORTRAN code and Powerpoint presentations. The contractor shall document these changes in the form of a draft journal article. In addition, the contractor shall analyze wind tunnel and Large Eddy Simulation (LES) results for building downwash (also provided by the WACOR) and shall propose further changes to the AERMOD model to account for an observed lateral shift in the portion of the pollutant plume that is entrained into the cavity downwind of a building. The contractor shall integrate proposed changes into the FORTRAN code of the AERMOD model and shall evaluate the changes against wind tunnel and LES databases.

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

None.

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, 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: 3/31/2018

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-119

☐ Other ☒ Amendment Number: 000002

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number 2

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 04/01/2017 To 03/31/2018

Comments:
The purpose of this amendment is to revise the PWS. PWS changes are highlighted. A revised work plan is due within 20 calendar 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: 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: Keith Pfeffer
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Performance Work Statement

WA Title: Fluid Modeling Facility Wind Tunnel Studies

WA #: 2-119 – Amendment 2 WACOR: David Heist

Contract #: EP-C-15-008 Alternate WACOR: Shawn Roselle

NOTE: This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment #1-119.

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

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 and 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 contractor shall design a measurement scheme to investigate the edge effects of roadside barriers when used in conjunction with a line sources.

The contractor shall design and test a line-segment source to be used in the experiments. The barriers shall be equivalent in height to a 6 m full-scale noise barrier and equal in length to the line-segment source. The barriers shall be located at varying distances from the line segment source (i.e., the simulated travel lane of the roadway), and located 1) so the barrier is parallel and directly downwind of the source, and 2) is parallel but shift one source length laterally. The above test shall be conducted with the roadway perpendicular and at 45 degrees to the approach wind. Using these configurations, the contractor shall 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 with approximately 15 profiles for each case.

The contractor shall also design and execute a measurement scheme to characterize the building downwash phenomena when two buildings are present. The contractor shall use two buildings of equal size and shall create four cases to examine. Specifically, the contract shall examine the effective building concept used in dispersion modeling to account for the presence of multiple buildings.

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: 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 3: The contractor shall document recently proposed changes to AERMOD model to improve the building downwash algorithms performance against the wind tunnel data described in Perry et al (Atmospheric Environment,142: 286-295). The proposed changes will be supplied by the WACOR in the form of FORTRAN code and Powerpoint presentations. The contractor shall document these changes in the form of a draft journal article. In addition, the contractor shall analyze wind tunnel and Large Eddy Simulation (LES) results for building downwash (also provided by the WACOR) and shall propose further changes to the AERMOD model to account for an observed lateral shift in the portion of the pollutant plume that is entrained into the cavity downwind of a building. The contractor shall integrate proposed changes into the FORTRAN code of the AERMOD model and shall evaluate the changes against wind tunnel and LES databases. [redacted]

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

None.

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, 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: 3/31/2018

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-120

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number 2

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 04/01/2017 To 03/31/2018

Comments:
Work plan due within 20 days.

☐ 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										
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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 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 Work Statement

WA Title: **Statistical models soil bioavailability**

WA #: 2-120 WACOR: Karen Bradham

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

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

SUMMARY OF OBJECTIVES

The purpose of this Work Assignment (WA) is to further the development and refinement of statistical models that predict soil metal bioavailability based on soil physicochemical properties to include:

1. Refinement of existing statistical model structure to modify how variability between hierarchical groups is accounted for in the model(s)
2. Prediction of additional response variables, including arsenic *in vivo* relative bioavailability
3. Sensitivity analysis of use of model predictions (As and Pb bioavailability) in risk assessment
4. Assistance in the preparation of manuscript(s) related to 1-3 above.

BACKGROUND

Previously, hierarchical statistical models were developed by US EPA's Office of Research and Development in collaboration with NC State's Department of Civil, Construction and Environmental Engineering, Raleigh, NC. The models provided preliminary quantitative, probabilistic relationships between soil arsenic and lead bioaccessibility and various soil geochemical predictor variables. Additional work is needed to refine model structure and better understand how model predictions can support risk determination of arsenic or lead contaminated soils.

SCOPE

In collaboration with EPA, contractor shall:

Task 1: Refine existing As/Pb bioaccessibility hierarchical model structure

Refinement of existing hierarchical models that predict As and Pb bioaccessibility is needed to allow for more robust variability characterization between hierarchical groups based on how model random and fixed effects are modeled.

Task 2: Develop hierarchical model(s) for prediction of arsenic in vivo relative bioavailability

Hierarchical models developed in task 1 shall be applied to prediction of As in vivo relative bioavailability data provided by EPA WACOR, with modifications to model structure as needed.

Task 3: Sensitivity analysis of use of model predictions in risk assessment of As/Pb contaminated soils.

A sensitivity analysis shall be performed to assess sensitivity in risk determinations of As or Pb contaminated soils when soil bioaccessibility data (either predicted or directly measured) is incorporated into calculations of hazard quotient.

Technical Approach

Statistical model development and refinement will reflect the hierarchical organization of the data (i.e., by contaminant source type and geographic location) and follow a Bayesian hierarchical (a.k.a. multilevel) framework capable of assessing and representing variability among different levels of organization. Sensitivity analyses will quantify how variability and uncertainty in input data, including bioaccessibility data and other variables used to calculate a risk assessment hazard quotient, influence risk determination of metal contaminated soils by applying a Monte Carlo or similar statistical approach. 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 EPA.

In addition to statistical model development and related statistical evaluation, work performed under this PWS will include assistance in preparation of at least one manuscript under the direction of EPA.

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

A computer and R software package are needed to complete work.

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.

DELIVERABLES

Deliverable	*Schedule*
Monthly progress reports to include current results summaries	Ongoing during performance period
R scripts	March 31, 2018
R input data files	March 31, 2018
Assistance in report and manuscript development, including text and figure development for manuscript relating soil lead bioaccessibility with soil physicochemical properties	November 30, 2017
Assistance in report and manuscript development, including text and figure development, for manuscript on sensitivity analysis of arsenic and lead bioavailability/bioaccessibility data in risk assessment	March 31, 2018

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-121

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018
Base Option Period Number 2

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 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17

☐ 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										
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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 Kevin Sudderth	Branch/Mail Code:
(Signature) (Date)	Phone Number: 919-541-3670
	FAX Number:
Project Officer Name Robin S. Harris	Branch/Mail Code:
(Signature) (Date)	Phone Number: 919-541-0955
	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

Performance Work Statement

WA Title: **Scientific and Technical Editing and Writing for the Exposure Methods and Measurement Division (EMMD)**

WA #: 2-121 WACOR: Kevin Sudderth

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

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

SUMMARY OF OBJECTIVES

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.

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.

SCOPE

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 WACOR 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 14 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 (Safe and Sustainable Water Resources) team as necessary. Due to the nature of the work being requested, technical clarification from the COR may be required. All technical clarification shall be documented by both the COR and contractor in writing. 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 Safe and Sustainable Water Resources 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.

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]).

TECHNICAL APROACH/OBJECTIVES

This WA does not require a specific technical approach.

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

None.

QUALITY ASSURANCE

No data is being generated. None

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]).

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

SCHEDULE of DELIVERABLES

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

The actual delivery date for each paper will vary depending on the amount of writing and revisions needed. The contractor shall provide the EPA WACOR with an expected delivery date after the initial conference call has been completed and all materials have been received.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-121

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number: 2

Title of Work Assignment/SF Site Name: Sci & Writing 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 04/01/2017 To 03/31/2018

Comments:
The purpose of this amendment is to change the editing of technical content requirement to up to 35 manuscripts. See attached PWS. All other terms and conditions remain unchanged.

☐ 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										
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3										
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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: Kevin Sudderth
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-3670
FAX Number:

Project Officer Name: Melissa Revely-Wilson
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0207
FAX Number:

Other Agency Official Name: Keith Pfeffer
(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:

Amendment 1 2-121

WA Title: **Scientific and Technical Editing and Writing for the Exposure Methods and Measurement Division (EMMD)**

WA #: 2-121 WACOR: Kevin Sudderth

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

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

SUMMARY:

The purpose of this amendment is to change SCOPE section **Task 2: Work Plan, Staffing Plan.**

The contractor shall be responsible for editing the technical content of up to 35 manuscripts total to be published as articles in peer-reviewed journal articles.

Performance Work Statement

WA Title: **Scientific and Technical Editing and Writing for the Exposure Methods and Measurement Division (EMMD)**

WA #: 2-121 WACOR: Kevin Sudderth

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

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

SUMMARY OF OBJECTIVES

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.

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.

SCOPE

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 35 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 (Safe and Sustainable Water Resources) 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 Safe and Sustainable Water Resources 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.

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]).

TECHNICAL APROACH/OBJECTIVES

This WA does not require a specific technical approach.

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

None.

QUALITY ASSURANCE

No data is being generated. None

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]).

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

SCHEDULE of DELIVERABLES

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

The actual delivery date for each paper will vary depending on the amount of writing and revisions needed. The contractor shall provide the EPA WAM with an expected delivery date after the initial conference call has been completed and all materials have been received.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-122

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018
Base Option Period Number 2

Title of Work Assignment/SF Site Name: Fine and Ultrafine Aerosol Mea

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 08/11/2017 To 03/31/2018

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 03/31/2018 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: Jonathan Krug
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-2379
FAX Number:

Project Officer Name: Melissa Revely-Wilson
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0207
FAX Number:

Other Agency Official Name: Keith Pfeffer
(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: Fine and Ultrafine Aerosol Measurement Validation

WA #: 2-122 WACOR: Jonathan Krug

Contract #: EP-C-15-008 Alternate WACOR: Robert Vanderpool

PERIOD OF PERFORMANCE

CO issuance through March 31, 2018.

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) laboratory evaluation of ultrafine aerosol samplers, (2) field evaluation of ultrafine aerosol samplers, and (3) reporting on the technical evaluation of ultrafine aerosol sampling instruments. 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. Laboratory Evaluation of Environmental Particle Counter (EPC) and other Ultrafine Instrumentation.

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. This common and controlled source is provided by EPA's UltraFine Chamber (UFC) for primary aerosol. In EPA's UFC sources of synthetic primary aerosol shall be generated by either nebulizer or electrostatic aerosol generation.

The contractor shall perform setup and reconfiguration of EPA's UFC testing chamber to be suitable for evaluation of ultrafine aerosol instrumentation. The contractor shall setup, calibrate, operate, and maintain multiple ultrafine aerosol measurement devices including but not limited to TSI Model 3783 Environmental Particle Counter (EPC), and the TSI Model 3085 Differential Mobility Analyzer in conjunction with TSI Model 3080 Electrostatic Classifier. Aerosol measurement devices will be Government Furnished Equipment. Measurements should be made from the UFC as determined by written Technical Direction from the EPA WACOR.

Task 2. Field Evaluation of Ultrafine Instrumentation

In support of NERL's research and development of new air monitoring methods and associated quality assurance procedures the contractor shall conduct field tests, as directed, related to the investigation of potential measurement anomalies, inaccuracies, or other technical deficiencies associated with the EPC. As indicated via written technical direction by the EPA's WACOR, the contractor shall employ the use of aerosol samplers during the field evaluation of the EPC including but not limited to: TSI Model 3031 Ultrafine Particle Monitor and the TSI Model 3085 Differential Mobility Analyzer in conjunction with TSI Model 3080 Electrostatic Classifier.

All instruments should have an up to date calibration and be operated consistent with the manufacturer's guidelines. Where required the appropriate inlet system should be determined and used in all field measurements. Procurement of additional laboratory supplies, to be consumed during performance of this work, may be required to complete this PWS as directed by EPA's WACOR. The total

duration of field measurements may be up to 2 months, however the site is anticipated to be in the local RTP commuting area and therefore overnight travel is not anticipated.

Task 3. Draft Manuscript

The contractor shall produce a draft manuscript for submission to a peer reviewed journal. The manuscript should document the laboratory and/or field evaluation of ultrafine aerosol devices as outlined in Tasks 1, 2. A literature review should be used to determine where directly comparable results are available in previously published peer reviewed literature.

QUALITY ASSURANCE (QA)

Data collection, calibration, and operation of scientific instruments shall be performed under a new Quality Assurance Project Plan (QAPP) to be developed by the contractor based on EPA Guidance for QAPPs (EPA QA/G-5). The QAPP should be approved by the WACOR and QAM prior to work starting.

Standard "good laboratory practices" for maintaining notebooks shall be employed.

The contractor shall follow the protocols, procedures and guidelines of the manufacturer's use manuals as provided.

DELIVERABLES

QAPP. A QAPP covering work outlined in Tasks 1 and 2 should be provided. The QAPP should be developed based on EPA Guidance for QAPPs (EPA QA/G-5).

Task 1. Laboratory Evaluation of Environmental Particle Counter (EPC) and other Ultrafine Instrumentation.

The contractor shall provide results from measurements made during the laboratory evaluation of ultrafine aerosol instrumentation. Raw and manipulated data shall be provided in electronic format as well as hard copy where required.

Task 2. Field Evaluation of Ultrafine Instrumentation.

The contractor shall provide data with results of the ultrafine instrument field evaluation in electronic format as well as hard copy where required.

Task 3. Delivery of draft manuscript.

The contractor shall provide a draft manuscript for suitable submission to a peer reviewed journal. The manuscript should document the laboratory and/or field evaluation of ultrafine aerosol devices as outlined in Tasks 1, 2 and by Technical Direction.

SCHEDULE of DELIVERABLES

QAPP: A QAPP should be delivered and approved prior to beginning work on Task 1.

Task 1: Target completion date: 01/30/2018.

Task 2: Target completion date: 01/30/2018.

Task 3: Target Delivery Date: one month following completion of Task 2.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-122

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number: 2

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 08/11/2017 To 03/31/2018

Comments:
The purpose of this amendment is to issue the attached Amendment 000001 PWS which replaces, in full, all prior PWS' for this WA.

☐ 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: Jonathan Krug
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-2379
FAX Number:

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

Other Agency Official Name: Keith Pfeffer
(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: Fine and Ultrafine Aerosol Measurement Validation

WA #: 2-122 WACOR: Jonathan Krug

Contract #: EP-C-15-008 Alternate WACOR: Robert Vanderpool

Amendment 000001 – This amended PWS replaces, in full, all prior PWS' for this WA.

PERIOD OF PERFORMANCE

CO issuance through March 31, 2018.

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) laboratory evaluation of ultrafine aerosol samplers, (2) field evaluation of ultrafine aerosol samplers, and (3) reporting on the technical evaluation of ultrafine aerosol sampling instruments. 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. Laboratory Evaluation of Environmental Particle Counter (EPC) and other Ultrafine Instrumentation.

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. This common and controlled source is provided by EPA's UltraFine Chamber (UFC) for primary aerosol. In EPA's UFC sources of synthetic primary aerosol shall be generated by either nebulized ammonium sulfate solution or polystyrene latex spheres.

The contractor shall perform setup and configuration of EPA's UFC testing chamber to be suitable for evaluation of ultrafine aerosol instrumentation. The contractor shall setup, calibrate, operate, and maintain multiple ultrafine aerosol measurement devices including two TSI Model 3783 Environmental Particle Counters (EPC), and the TSI Model 3085 Differential Mobility Analyzer in conjunction with TSI Model 3080 Electrostatic Classifier. Aerosol measurement devices will be Government Furnished Equipment. Following UFC setup, measurements should be made from the UFC for approximately six weeks to complete the inter-instrument evaluation as determined by written Technical Direction from the EPA WACOR.

Task 2. Field Evaluation of Ultrafine Instrumentation

In support of NERL's research and development of new air monitoring methods and associated quality assurance procedures the contractor shall conduct field tests, as directed, related to the investigation of potential measurement anomalies, inaccuracies, or other technical deficiencies associated with the EPC. In addition to the two EPC instruments, the contractor shall employ the use of a TSI Model 3085 Differential Mobility Analyzer in conjunction with TSI Model 3080 Electrostatic Classifier.

The field site will be NRMRL's Triple-Oak Near Road Monitoring site at which housing for the instruments will be provided. The appropriate inlet system should be used in all field measurements. While the majority of the sampling system will be provided, procurement of additional supplies may be required to complete this PWS as directed by EPA's WACOR. All instruments should have an up to date calibration and be operated consistent with the manufacturer's guidelines. The

installation and setup of field measurements should begin following the conclusion of Task 1 and should continue until March 2nd, 2018. The contractor should perform site visits twice per week to ensure proper operation of the instruments, refill consumables, perform maintenance as required, and download data for backup. The contractor is not responsible for instrument take-down at the conclusion of Task 2. The Triple-Oaks site is in the local RTP commuting area and therefore overnight travel is not anticipated.

Task 3. Data analysis

The contractor shall review and analyze data generated in Tasks 1 and 2 as it is collected. Data should be checked for quality and completeness in accordance with the QAPP. Data generated in Task 1 should be used to demonstrate the inter-instrument variance in a controlled environment based on differing particle size distributions. Data generated in Task 2 should be used to show inter-instrument variance based on time-series measurements. Data from Task 2 should also be combined on a time-series basis with meteorology and, if available, traffic data from the Triple-Oaks site as provided by NRMRL.

QUALITY ASSURANCE (QA)

Data collection, calibration, and operation of scientific instruments shall be performed under a new Quality Assurance Project Plan (QAPP) to be developed by the contractor based on EPA Guidance for QAPPs (EPA QA/G-5). The QAPP should be approved by the WACOR and QAM prior to work starting.

Standard "good laboratory practices" for maintaining notebooks shall be employed.

The contractor shall follow the protocols, procedures and guidelines of the manufacturer's use manuals as provided.

DELIVERABLES

QAPP. A QAPP covering work outlined in Tasks 1 and 2 should be provided. The QAPP should be developed based on EPA Guidance for QAPPs (EPA QA/G-5).

Task 1. Laboratory Evaluation of Environmental Particle Counter (EPC) and other Ultrafine Instrumentation.

The contractor shall provide results from measurements made during the laboratory evaluation of ultrafine aerosol instrumentation. Raw and manipulated data shall be provided in electronic format as well as hard copy where required.

Task 2. Field Evaluation of Ultrafine Instrumentation.

The contractor shall provide data with results of the ultrafine instrument field evaluation in electronic format as well as hard copy where required.

Task 3. Delivery of analyzed data.

The contractor shall provide electronic copies of final analyzed data from Task 3.

SCHEDULE of DELIVERABLES

QAPP: A QAPP should be delivered and approved prior to beginning work on Task 1.

Task 1: Target completion date: 12/01/2017.

Task 2: Target completion date: 03/02/2018.

Task 3: Target Delivery Date: at the conclusion of the option period.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-123

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number 2

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 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17

☐ 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 03/31/2018 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 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

WA Title: Tire Crumb Rubber Research Field and Laboratory Support

WA Short Title: TCRS Support

WA #: 2-123 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 April 1, 2017 through March 31, 2018.

SUMMARY OF OBJECTIVES

The work assignment objective is to provide field sampling and laboratory support for research on synthetic turf fields with tire crumb rubber infill. Specifically, the contractor shall provide support for sample and video activity data 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'.

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 human exposure and 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 finalized in February 2016. The U.S. EPA and CDC/ATSDR have jointly prepared a peer-reviewed Research Protocol to implement portions of these research activities outlined under the FRAP https://www.epa.gov/chemical-research/research-protocol-collections-related-synthetic-turf-fields-crumb-rubber-infill. A December 2016 status report on the overall Federal Research Action Plan is available https://www.epa.gov/chemical-research/december-2016-status-report-federal-research-action-plan-recycled-tire-crumb.

For this work assignment, the major activity to be implemented via the research protocol is:

1) Provide field and laboratory support for the human exposure characterization elements of the 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.

The sample and video activity 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 and environmental samples to be collected include:

1) personal air samples for VOCs,
2) personal dermal wipes for SVOCs and metals,
3) field air samples for VOCs, SVOCs, and metals/particulates,
4) field wipe samples for metals and SVOCs,
5) field drag sled sampling for SVOCs, and,
6) field dust/particles for metals and SVOCs.

A subset of participants (adults and children) will also have video data collection performed while playing or practicing during a physical activity (i.e., soccer, football, field hockey) 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, shipment, and processing of environmental and personal samples, and collection and shipment of video files, in the exposure characterization portion of the study for up to 45 participants at up to 6 fields,
2) participation in a pre-pilot test of selected SOPs at one field, and,
3) data extraction and enumeration for the video activity information.

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. EPA will be responsible for preparing draft and final versions of these documents. Prior to finalizing the QAPP, the contractor shall review and include essential organizational information. 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: Available at the web site cited above.

b) QAPPs: The draft QAPPs for the exposure characterization portion of the study and for video data collection are anticipated to be available by April 1, 2017.

c) SOPs: Most of the draft SOPs for the exposure characterization sample and data collection are anticipated to be available by April 1, 2017. Draft SOPs for personal VOC sample collection and field dust/particle sample collection may still be in progress; drafts will be provided as soon as they are available.

d) Final approved QAPPs and all SOPs will be available prior to the start of the full field study.

The planned scheduling goal is for field sample collection during mid-summer through fall of 2017. However, the timing of the field study remains uncertain and depends on successful completion of the OMB ICR approval process and participant recruitment.

The contractor shall schedule a meeting with the WACOR within 5 business days of receipt of the work assignment package from the Contract Officer.

TECHNICAL APPROACH/OBJECTIVES

Task 1: Field Sample and Data Collection for the Exposure Characterization Study

The CDC IRB and the EPA Human Subjects Research Review Official have reviewed and approved the Research Protocol. The contractor shall enter into an IRB reliance agreement with the CDC IRB responsible for human subjects protection under the Research Protocol and provide the WACOR with a copy (hardcopy and electronic) of this approved IRB reliance agreement form prior to field sampling activities. All

contractor staff members engaged in activities with human research participants in the exposure characterization portions of the study must complete contractor-required human subjects training.

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 EPA and CDC/ATSDR staff or other designated contractors as needed to implement the exposure characterization study.

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 within the contiguous U.S. that are a subset of the fields that participated in the activities for the previous Tire Crumb Rubber Characterization study. 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 (air and dermal wipe) 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/particle 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.

A subset of fields that were sampled in the previous tire crumb rubber characterization portion of the study have agreed to allow participant recruitment and sample collection for the exposure characterization portion of the study. The WACOR will provide information to the contractor regarding the locations of these fields to assist in estimating travel and shipping costs. Fewer than 45 participants, and fewer than 6 fields, may be sampled if EPA and CDC/ATSDR are unable to recruit a sufficient number of participants.

Up to 24 of the 45 participants in the exposure measurement study will also be recruited by CDC/ATSDR to participate in the video recording activity. Prior to video recording of participants, the EPA WACOR will hold a half-day session at the EPA laboratory to demonstrate to the contractor how field technicians should correctly videotape participant activities while playing/practicing on turf. Video recording (up to 1.5 hours per person) 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 either by driving the equipment to the field location and/or using air or ground delivery services.

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.

Task 2: Pre-Pilot Testing

EPA will attempt to identify a field that will allow pre-pilot testing of sample and video collection SOPs prior implementing the full exposure characterization study. The purpose of the pre-pilot testing is to assess draft SOPs and allow familiarization with materials, procedures, and equipment. It is anticipated that the pre-pilot testing will be conducted by EPA staff and contractor staff over a week that will include material and equipment preparation and staging, implementation of SOPs at a field on one day, equipment and material clean-up and re-packaging, and meetings to discuss procedures and any recommendations for SOP revisions.

EPA will attempt to recruit a field in the Research Triangle Park, NC vicinity for pre-pilot testing. The WACOR will provide field information to the contractor and will communicate with the contractor regarding scheduling.

Task 3: Video Activity Data Extraction

Video activity data collection will be performed for up to 24 exposure characterization study participants in Task 1. It is anticipated that each participant will have up to approximately 1.5 hours of recorded activity (via a video camera) while playing on synthetic turf fields. Under Task 3, contractor staff will follow the SOP to extract and enumerate on structured data forms the frequencies of selected human activity types (i.e., hand-to-mouth events) observed during viewing of the participant videos on a large computer monitor in a laboratory setting. Prior to beginning video data

extraction, contractor staff members will participate in two days of procedural demonstrations by the EPA WACOR with practice extractions. Activity data will then be translated from each participant's videotape by two different contractor staff members to generate replicate activity data sets for each participant. Differences in activity results greater than specified acceptability limits in the QAPP and/or SOP will be resolved through additional viewing and translation of the videotapes.

The contractor shall follow all requirements for data documentation. The contractor shall also follow all requirements for information data security and privacy protection as described in the SOP, QAPP, Research Protocol and consent forms. Human data protection requirements require the use of a non-networked computer system when viewing participant videotapes in a private setting. The contractor shall transfer all activity data records (hardcopy and electronic) to the EPA WACOR.

QUALITY ASSURANCE

The contractor shall use the QAPPs and SOPs provided by EPA. Prior to EPA finalization of the exposure characterization field sample collection QAPP, the contractor shall review and include essential organizational information. Recommendations for essential revisions to the QAPP and SOP documents can be provided to, and will be considered by the WACOR. The contractor shall participate in systems and data audits performed by EPA QA staff and/or 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: Field Sample and Data Collection for the Exposure Characterization Study

The planned scheduling goal is for field sample collection during mid-summer through fall of 2017. However, the timing of the field study remains uncertain and depends on successful completion of the OMB ICR approval process and participant recruitment. It is possible the work could begin 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 personal and field samples to the analysis laboratories within one week of receipt from exposure characterization sampling. The contractor shall provide field collection data, video activity information, and data (electronic and hardcopy) to the EPA WACOR within one week of receipt from exposure characterization sampling at each field.

Task 2: Pre-Pilot Testing

Pre-pilot testing would ideally be performed in May or June, 2017, but the schedule depends on field availability and overall project scheduling requirements. The contractor shall consult with the EPA WACOR on efficient scheduling for implementation. Contractor staff will participate in meetings with the EPA WACOR and other EPA staff over portions of the two business days following the field sampling day to provide feedback on protocol and SOP procedures and implementation.

Task 3: Video Activity Data Extraction

The contractor shall consult with the EPA WACOR on efficient scheduling for the demonstration and practice dates. Video activity data extraction and delivery to the EPA WACOR, shall be completed within three weeks following the completion of the final exposure field study data collection. Meeting this schedule requirement will likely mean beginning the video data extraction activity while field data collection activities are underway.

The contractor shall lead and direct the field sample and data collection activities and have experience that includes environmental and/or human exposure measurement field sampling. The contractor shall perform field sampling activities 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 the field sample and data collection, and the video activity data activities must have any contractor required human subjects training.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-123

☐ 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 X Option Period Number	WA 2-123

Contractor	Specify Section and paragraph of Contract SOW
JACOBS TECHNOLOGY INC.	Deliverables and schedule under Task 1 (pages 6-7)

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

Period of Performance: From 04/01/2017 To 03/31/2018

Comments:
Amendment 1 -- PWS changes are highlighted in yellow. All other terms and conditions remain unchanged.

☐ 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: 04/01/2017 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 Marsha Morgan (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-2598 FAX Number:	
Project Officer Name Melissa Revely-Wilson (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-0207 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 000001

WA Title: Tire Crumb Rubber Research Field and Laboratory Support

WA Short Title: TCRS Support

WA #: 2-123 WACOR: Marsha Morgan

Contract #: EP-C-15-008 Alternate WACOR: Kent Thomas

Amendment 000001 changes are highlighted in yellow.

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Statement of Work (SOW) shall be from April 1, 2017 through March 31, 2018.

SUMMARY OF OBJECTIVES

The work assignment objective is to provide field sampling and laboratory support for research on synthetic turf fields with tire crumb rubber infill. Specifically, the contractor shall provide support for sample and video activity data 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'.

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 human exposure and 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 finalized in February 2016. The U.S. EPA and CDC/ATSDR have jointly prepared a peer-reviewed Research Protocol to implement portions of these research activities outlined under the FRAP https://www.epa.gov/chemical-research/research-protocol-collections-related-synthetic-turf-fields-crumb-rubber-infill. A December 2016 status report on the overall Federal Research Action Plan is available https://www.epa.gov/chemical-research/december-2016-status-report-federal-research-action-plan-recycled-tire-crumb.

For this work assignment, the major activity to be implemented via the research protocol is:

1) Provide field and laboratory support for the human exposure characterization elements of the 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.

The sample and video activity 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 and environmental samples to be collected include:

1) personal air samples for VOCs,
2) personal dermal wipes for SVOCs and metals,
3) field air samples for VOCs, SVOCs, and metals/particulates,
4) field wipe samples for metals and SVOCs,
5) field drag sled sampling for SVOCs, and,
6) field dust/particles for metals and SVOCs.

A subset of participants (adults and children) will also have video data collection performed while playing or practicing during a physical activity (i.e., soccer, football, field hockey) 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, shipment, and processing of environmental and personal samples, and collection and shipment of video files, in the exposure characterization portion of the study for up to 45 participants at up to 6 fields,
2) participation in a pre-pilot test of selected SOPs at one field, and,
3) data extraction and enumeration for the video activity information.

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. EPA will be responsible for preparing draft and final versions of these documents. Prior to finalizing the QAPP, the contractor shall review and include essential organizational information. 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: Available at the web site cited above.

b) QAPPs: The draft QAPPs for the exposure characterization portion of the study and for video data collection are anticipated to be available by April 1, 2017.

c) SOPs: Most of the draft SOPs for the exposure characterization sample and data collection are anticipated to be available by April 1, 2017. Draft SOPs for personal VOC sample collection and field dust/particle sample collection may still be in progress; drafts will be provided as soon as they are available.

d) Final approved QAPPs and all SOPs will be available prior to the start of the full field study.

The planned scheduling goal is for field sample collection during mid-summer through fall of 2017. However, the timing of the field study remains uncertain and depends on successful completion of the OMB ICR approval process and participant recruitment.

The contractor shall schedule a meeting with the WACOR within 5 business days of receipt of the work assignment package from the Contract Officer.

TECHNICAL APPROACH/OBJECTIVES

Task 1: Field Sample and Data Collection for the Exposure Characterization Study

The CDC IRB and the EPA Human Subjects Research Review Official have reviewed and approved the Research Protocol. The contractor shall enter into an IRB reliance agreement with the CDC IRB responsible for human subjects protection under the Research Protocol and provide the WACOR with a copy (hardcopy and electronic) of this approved IRB reliance agreement form prior to field sampling activities. All

contractor staff members engaged in activities with human research participants in the exposure characterization portions of the study must complete contractor-required human subjects training.

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 EPA and CDC/ATSDR staff or other designated contractors as needed to implement the exposure characterization study.

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 within the contiguous U.S. that are a subset of the fields that participated in the activities for the previous Tire Crumb Rubber Characterization study. 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 (air and dermal wipe) 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/particle 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.

A subset of fields that were sampled in the previous tire crumb rubber characterization portion of the study have agreed to allow participant recruitment and sample collection for the exposure characterization portion of the study. The WACOR will provide information to the contractor regarding the locations of these fields to assist in estimating travel and shipping costs. Fewer than 45 participants, and fewer than 6 fields, may be sampled if EPA and CDC/ATSDR are unable to recruit a sufficient number of participants.

Up to 24 of the 45 participants in the exposure measurement study will also be recruited by CDC/ATSDR to participate in the video recording activity. Prior to video recording of participants, the EPA WACOR will hold a half-day session at the EPA laboratory to demonstrate to the contractor how field technicians should correctly videotape participant activities while playing/practicing on turf. Video recording (up to 1.5 hours per person) 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 either by driving the equipment to the field location and/or using air or ground delivery services.

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.

Task 2: Pre-Pilot Testing

EPA will attempt to identify a field that will allow pre-pilot testing of sample and video collection SOPs prior implementing the full exposure characterization study. The purpose of the pre-pilot testing is to assess draft SOPs and allow familiarization with materials, procedures, and equipment. It is anticipated that the pre-pilot testing will be conducted by EPA staff and contractor staff over a week that will include material and equipment preparation and staging, implementation of SOPs at a field on one day, equipment and material clean-up and re-packaging, and meetings to discuss procedures and any recommendations for SOP revisions.

EPA will attempt to recruit a field in the Research Triangle Park, NC vicinity for pre-pilot testing. The WACOR will provide field information to the contractor and will communicate with the contractor regarding scheduling.

Task 3: Video Activity Data Extraction

Video activity data collection will be performed for up to 24 exposure characterization study participants in Task 1. It is anticipated that each participant will have up to approximately 1.5 hours of recorded activity (via a video camera) while playing on synthetic turf fields. Under Task 3, contractor staff will follow the SOP to extract and enumerate on structured data forms the frequencies of selected human activity types (i.e., hand-to-mouth events) observed during viewing of the participant videos on a large computer monitor in a laboratory setting. Prior to beginning video data

extraction, contractor staff members will participate in two days of procedural demonstrations by the EPA WACOR with practice extractions. Activity data will then be translated from each participant's videotape by two different contractor staff members to generate replicate activity data sets for each participant. Differences in activity results greater than specified acceptability limits in the QAPP and/or SOP will be resolved through additional viewing and translation of the videotapes.

The contractor shall follow all requirements for data documentation. The contractor shall also follow all requirements for information data security and privacy protection as described in the SOP, QAPP, Research Protocol and consent forms. Human data protection requirements require the use of a non-networked computer system when viewing participant videotapes in a private setting. The contractor shall transfer all activity data records (hardcopy and electronic) to the EPA WACOR.

QUALITY ASSURANCE

The contractor shall use the QAPPs and SOPs provided by EPA. Prior to EPA finalization of the exposure characterization field sample collection QAPP, the contractor shall review and include essential organizational information. Recommendations for essential revisions to the QAPP and SOP documents can be provided to, and will be considered by the WACOR. The contractor shall participate in systems and data audits performed by EPA QA staff and/or 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: Field Sample and Data Collection for the Exposure Characterization Study

The planned scheduling goal is for field sample collection during mid-summer through fall of 2017. However, the timing of the field study remains uncertain and depends on successful completion of the OMB ICR approval process and participant recruitment. It is possible the work could begin 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 be responsible for the preparation of materials and equipment for exposure characterization sampling at up to six turf fields. These activities shall be performed:

21 days after EPA has identified the location of (individual) turf field facilities and Jacobs is in receipt of:

- Facility access agreements and sampling authorization documentation
- Conditionally approved QA documents (QAPP and all necessary SOPs)

Completed/signed study participant informed consent forms shall be obtained by Jacobs at least 2-hours before any field sampling activities (involving human subjects) begins.

The contractor shall provide personal and field samples to the analysis laboratories within one week of receipt from exposure characterization sampling. The contractor shall provide field collection data, video activity information, and data (electronic and hardcopy) to the EPA WACOR within one week of receipt from exposure characterization sampling at each field.

Task 2: Pre-Pilot Testing

Pre-pilot testing would ideally be performed in May or June, 2017, but the schedule depends on field availability and overall project scheduling requirements. The contractor shall consult with the EPA WACOR on efficient scheduling for implementation. Contractor staff will participate in meetings with the EPA WACOR and other EPA staff over portions of the two business days following the field sampling day to provide feedback on protocol and SOP procedures and implementation.

Task 3: Video Activity Data Extraction

The contractor shall consult with the EPA WACOR on efficient scheduling for the demonstration and practice dates. Video activity data extraction and delivery to the EPA WACOR, shall be completed within three weeks following the completion of the final exposure field study data collection. Meeting this schedule requirement will likely mean beginning the video data extraction activity while field data collection activities are underway.

The contractor shall lead and direct the field sample and data collection activities and have experience that includes environmental and/or human exposure measurement field sampling. The contractor shall perform field sampling activities 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 the field sample and data collection, and the video activity data activities must have any contractor required human subjects training.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-124

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number 2

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 04/01/2017 To 03/31/2018

Comments:
Work plan due within 20 days of work assignment award.

☐ 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 03/31/2018 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 Work Statement

WA Title: **Inorganic laboratory support for soil bioavailability**

WA #:2-124 WACOR: Karen Bradham

Contract #: EP-C-15-008 Alternate WACOR: n/a

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

SUMMARY OF OBJECTIVES

The purpose of this Work Assignment (WA) is to provide laboratory support related to assessing the bioavailability and bioaccessibility of inorganic contaminants in soil, dust, biological tissues, and other environmental matrices. Laboratory support includes preparation and analysis of standards and samples and associated recordkeeping, including:

1. Acid extraction/digestion of samples to assess the bioaccessibility and bioavailability of soil and dust inorganics
2. Analyses of extracts using Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES)
3. Revising standard operating procedures (SOPs) as needed
4. Technical editing assistance for manuscript(s) related to 1-2 above.

BACKGROUND

Assessing the bioavailabiliity of inorganic contaminants in soil, dust and similar matrices involves the quantification of elemental totals and biologically-relevant extractable fractions in the matrix of interest. These data and methods provide reliable information needed to evaluate human exposures to these elements.

SCOPE

In collaboration with EPA, the Contractor shall:

Task 1: Assist with laboratory analyses to assess the bioaccessibility and bioavailability of soil and dust inorganics, including:

- In vitro extraction testing to evaluate the bioaccessibility of select inorganic elements, including but not limited to lead and arsenic, in residential soil and dust in accordance with EPA Method 9200.2-86 and relevant standard operating procedures provided by EPA WACOR.
- Microwave assisted acid digestion of soils, dusts and biological tissues in accordance with EPA Method 3051A and relevant standard operating procedures provided by EPA WACOR.

- Soil and dust drying, sieving and percent dry weight determination in accordance with standard operating procedures provided by EPA WACOR.
- Maintaining laboratory notebook, records, and inventories of laboratory supplies.

Task 2: Analyses of extracts using Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES)

- Analyses of sample extracts using ICP-OES to include preparing quality assurance standards in accordance with EPA Method 6010D and relevant standard operating procedure provided by EPA WACOR. QC analysis of data, formatting and maintaining database, maintaining laboratory notebook and records, and preparing glassware for standards.

Task 3: Revise existing inorganic SOPs in collaboration with EPA WACOR or WACOR designees as needed to complete Tasks 1 and 2.

- Revise SOPs in collaboration with EPA WACOR or designees as needed to successfully complete tasks 1 and 2.

Task 4. Technical editing assistance for manuscript(s) related to 1-3 above.

- Assist with quality control reviews of data, maintain databases, formating and editing of journal articles.

While exact numbers of samples to be prepared, extracted and analyzed (and associated data summary reports) is unknown in advance, it is anticipated that approximately 850 hours of work will be necessary to successfully complete the tasks above, with work spread out evenly throughout the performance period.

Technical Approach

Laboratory samples (including soil, dust, and biological samples) and associated QA/QC samples will be prepared, extracted and analyzed following relevant EPA methods and standard operating procedures previously described.

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

All laboratory equipment and standards necessary to complete these tasks, including in vitro soil bioaccessibility extraction device, microwave digestion unit(s), ICP-OES and associated standards, will be made available by WACOR or WACOR designees. Contractor shall coordinate use of equipment with WACOR or WACOR designees, as instruments are routinely in use by other laboratory personnel.

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) for quality control and assurance. In particular, *Section 4. Experimental Design* describes extraction and digestion methods and analytical analysis by ICP-OES for soil and biological samples, and *Section 5. Quality Assurance/Quality Control*

describes QA objectives. Table 1 of the QAPP summarizes relevant SOPs (which include additional QA objectives specific to that SOP) associated with laboratory methods described in this PWS. The QAPP may be amended by the WACOR to include additional project personnel.

DELIVERABLES

Deliverables	*Schedule*
Data summary reports	Provided as data becomes available (at a minimum monthly) throughout performance period
Monthly report describing lab work conducted	Provided monthly throughout performance period
Revisions to standard operating procedure(s)	As requested by WACOR, revisions to SOP(s) will be provided within one month of request.
Technical editing support	As requested by WACOR, technical editing of manuscripts or reports associated with tasks described in this PWS will be provided within one month of request.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-124

☐ 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 2	Inorganic 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 04/01/2017 To 03/31/2018

Comments:
1) "Task 5" is added to the attached Amendment 000001 PWS.

2) A Work Plan is due within 20 calendar days.

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 03/31/2018 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 Keith Pfeffer (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:	

Performance Work Statement

WA Title: **Inorganic laboratory support for soil bioavailability**

WA #:2-124 WACOR: Karen Bradham

Contract #: EP-C-15-008 Alternate WACOR: n/a

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

SUMMARY OF OBJECTIVES

The purpose of this Work Assignment (WA) is to provide laboratory support related to assessing the bioavailability and bioaccessibility of inorganic contaminants in soil, dust, biological tissues, and other environmental matrices. Laboratory support includes preparation and analysis of standards and samples and associated recordkeeping, including:

1. Acid extraction/digestion of samples to assess the bioaccessibility and bioavailability of soil and dust inorganics
2. Analyses of extracts using Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES)
3. Revising standard operating procedures (SOPs) as needed
4. Technical editing assistance for manuscript(s) related to 1-2 above
5. Procurement of laboratory supplies as needed to support tasks 1 and 2 above

BACKGROUND

Assessing the bioavailabiliity of inorganic contaminants in soil, dust and similar matrices involves the quantification of elemental totals and biologically-relevant extractable fractions in the matrix of interest. These data and methods provide reliable information needed to evaluate human exposures to these elements.

SCOPE

In collaboration with EPA WACOR and EPA employees designated by EPA WACOR, Contractor shall:

Task 1: Assist with laboratory analyses to assess the bioaccessibility and bioavailability of soil and dust inorganics, including:

- In vitro extraction testing to evaluate the bioaccessibility of select inorganic elements, including but not limited to lead and arsenic, in residential soil and dust in accordance with EPA Method 9200.2-86 and relevant standard operating procedures provided by EPA WACOR.
- Microwave assisted acid digestion of soils, dusts and biological tissues in accordance with EPA Method 3051A and relevant standard operating procedures provided by EPA WACOR.

- Soil and dust drying, sieving and percent dry weight determination in accordance with standard operating procedures provided by EPA WACOR.
- Maintaining laboratory notebook, records, and inventories of laboratory supplies.

Task 2: Analyses of extracts using Inductively Coupled Plasma-Optical Emission Spectrometry (ICP-OES)

- Analyses of sample extracts using ICP-OES to include preparing quality assurance standards in accordance with EPA Method 6010D and relevant standard operating procedure provided by EPA WACOR. QC analysis of data, formatting and maintaining database, maintaining laboratory notebook and records, and preparing glassware for standards.

Task 3: Revise existing inorganic SOPs in collaboration with EPA WACOR or WACOR designees as needed to complete Tasks 1 and 2.

- Revise SOPs in collaboration with EPA WACOR or designees as needed to successfully complete tasks 1 and 2.

Task 4. Technical editing assistance for manuscript(s) related to 1-3 above.

- Assist with quality control reviews of data, maintain databases, formating and editing of journal articles.

Task 5. Procurement of laboratory supplies as needed to support tasks 1 and 2 above

- Procure laboratory supplies (lab consumables and chemicals) to assist in successful completion of tasks 1 and 2 above. All lab procurements shall be approved by WACOR prior to initiation of purchase by Contractor.

While exact numbers of samples to be prepared, extracted and analyzed (and associated data summary reports) is unknown in advance, it is anticipated that approximately 850 hours of work will be necessary to successfully complete the tasks above, with work spread out evenly throughout the performance period.

Technical Approach

Laboratory samples (including soil, dust, and biological samples) and associated QA/QC samples will be prepared, extracted and analyzed following relevant EPA methods and standard operating procedures previously described.

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

All laboratory equipment necessary to complete these tasks, including in vitro soil bioaccessibility extraction device, microwave digestion unit(s), ICP-OES will be made available by WACOR or WACOR designees. Contractor shall coordinate use of equipment with WACOR or WACOR designees, as instruments are routinely in use by other laboratory personnel. Chemical standards and consumables

(such as sample tubes, pipette tips, etc) will also be provide by WACOR or WACOR designees. However, procurement of additional chemical standards and consumables may be necessary for successful completion of WA tasks. If needed, procurement of standards and consumables shall be approved by WACOR prior to initiation of purchase by Contractor.

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) for quality control and assurance. In particular, *Section 4. Experimental Design* describes extraction and digestion methods and analytical analysis by ICP-OES for soil and biological samples, and *Section 5. Quality Assurance/Quality Control* describes QA objectives. Table 1 of the QAPP summarizes relevant SOPs (which include additional QA objectives specific to that SOP) associated with laboratory methods described in this PWS. The QAPP may be amended by the WACOR to include additional project personnel.

DELIVERABLES

Deliverables	*Schedule*
Data summary reports	Provided as data becomes available (at a minimum monthly) throughout performance period
Monthly report describing lab work conducted	Provided monthly throughout performance period
Revisions to standard operating procedure(s)	As requested by WACOR, revisions to SOP(s) will be provided within one month of request.
Technical editing support	As requested by WACOR, technical editing of manuscripts or reports associated with tasks described in this PWS will be provided within one month of request.

EPA	United States Environmental Protection Agency Washington, DC 20460 **Work Assignment**	Work Assignment Number 2-126 ☐ Other ☐ Amendment Number:

Contract Number	Contract Period 04/01/2015 To 03/31/2018	Title of Work Assignment/SF Site Name
EP-C-15-008	Base Option Period Number 2	Mobile monitoring

Contractor	Specify Section and paragraph of Contract SOW
JACOBS TECHNOLOGY INC.	

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

Period of Performance
From 04/01/2017 To 03/31/2018

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 03/31/2018 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 Andrea Clements	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-1363 FAX Number:
Project Officer Name Melissa Revely-Wilson	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-0207 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: Mangrove Monitoring & Sensor Review

WA #: 2-126 WACOR: Ron Williams

Contract #: EP-C-15-008 Alternate WACOR: Andrea Clements

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

SUMMARY OF OBJECTIVES

Scientific understanding of the rates, patterns, and causes of changes in mangrove cover, and the impacts of such changes on ecosystem services, is limited. To help fill this gap, we propose to examine the dynamics of mangrove forests from 1985 to present—this will help assess the consequences for two globally important ecosystem services, carbon sequestration and biodiversity conservation. To do this, we will integrate research in remote sensing, conservation biology, and environmental economics. Specific objectives of the project are:

Objective 1: develop an operational methodology for detecting and monitoring mangrove cover dynamics on an annual basis;

Objective 2: create a comprehensive database of mangrove cover change on an annual basis from 1985 to the present at 30 m resolution;

Objective 3: quantify carbon stock change on an annual basis

Recent advances in low-cost sensor technologies for air, water, and land quality are inspiring environmental scientists and the general public to experiment with these devices. Potential uses for new air sensor technologies include measuring local air quality for personal and community environmental health concerns and science education, locating costly leaks at industrial facilities, participating in citizen science, conducting research, and supplementing air quality measurements for regulatory compliance. Initial technical evaluations of these new devices are promising for a variety of needs. Rapid developments coupled with keen interest in the new technologies and accessible data have the potential to soundly transform future environmental monitoring. To keep abreast of this emerging technology, our objective will be to:

Objective 4: Review Sensor technologies to measure and monitor air, water, and land quality

BACKGROUND

Remaining global mangrove areas comprise 137,760 square kilometers, spanning 118 countries and territories in the tropical and subtropical regions of the world. They are among the world's most threatened and rapidly declining ecosystems.

However, our scientific understanding of the rates, patterns, causes, and consequences of mangrove change is limited. With the availability of remote sensing technology, it is now possible to map and monitor mangroves on an annual basis.

Mangroves are highly productive ecosystems that store more carbon than any other tropical ecosystem per unit of area. They have a mean whole-ecosystem carbon stock (i.e., above-ground plus below-ground) of 956 t C ha^{-1}, compared to 142 t C ha^{-1} for seagrasses, 241 t C ha^{-1} for tropical rain forests, 408 t C ha^{-1} for peat swamps, and 593 t C ha^{-1} for salt marshes. Soil carbon constitutes approximately 75% of the mangrove carbon pool. Although mangroves occupy less than 1% of global coastal area, they contribute 10–15% (24 Tg C y^{-1}) to coastal sediment carbon storage and export 10–11% of total particulate terrestrial carbon to the ocean.

Mangroves' disproportionate contribution to carbon storage is now perceived as a means and justification for enhanced conservation and restoration and a way to help mitigate greenhouse gas emissions. The best available estimates indicate that 0.15–1.02 Pg (billion) tons of carbon dioxide are being released from mangroves annually due to deforestation and forest degradation, causing economic damages of US$6–42 billion annually. The magnitudes of carbon stocks, carbon stock variability, and changes in carbon stocks in mangroves are still active and contested areas of research, however, with uncertainty in the estimation of deforestation, degradation, and carbon stock changes in mangroves remaining very high. Reliable annual estimates of deforestation, forest degradation, and associated carbon stock changes are needed at a national scale to support inclusion of mangroves in the United Nations Collaborative Program on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD+), as well as to advance NASA's Carbon Monitoring System research. Development of a prototype Monitoring Reporting and Verification (MRV) system for mangroves in developing countries is urgently needed to generate transparent estimates that achieve the levels of accuracy and precision required by current UNFCCC guidance. In the absence of such information, the blue carbon market will be slow to emerge, as investors in carbon sequestration projects demand a high level of certainty about project quality.

Similarly, recent advances in low-cost sensor technologies for air, water, and land quality are becoming extremely useful for scientists and the general public to measure and monitor air, water, and land quality. Research is being carried out by government, academia, and private sector. Rapid development of this technology in the recent past might provide an opportunity to improve our scientific understanding of air, water, and land quality.

SCOPE

The contractor will initially work on the study region including coastal mangrove areas in USA, Bahamas, Puerto Rico, Bangladesh, India, Myanmar, Pakistan, and Sri Lanka. However, over time, it will be expanded to other regions of the world.

Second component of the research will include review of literature on sensor technologies.

Specific responsibilities shall include:

- Downloading of satellite data from multiple sources
- Development of 30 meters' mangrove data from Landsat satellite data using software such as ERDAS Imagine.
- Analysis of land cover maps for ecosystem services and sustainability
- GIS (Geographic Information System) processing of data layers
- Quality control of geospatial data
- Creation of metadata and fact sheets supporting the data products
- Assist in field data collection
- Literature review on sensor technology

TECHNICAL APROACH/OBJECTIVES

Task 1: The contractor will map and monitor mangroves on an annual basis from 1985 to the present. This will improve upon the contemporary remote sensing methods developed in our previous research, which mapped and monitored mangroves on a periodic basis (i.e., every 5–10 years). These previous studies generated data on the distribution, density, and species composition of mangrove forests from local to global scales. Landsat data are available and suitable for the annual analysis in this study. We will use high resolution satellite data such as GeoEye and WorldView (available from the National Geospatial Agency, restricted use) for training and validation purposes. Other ancillary data such as SRTM 30 m DEM and forest inventory data will also be used. Our aim is to generate information on deforestation (i.e., mangroves converted to other land uses), degradation (i.e., mangroves remain but have reduced density), and regrowth

We have developed and tested a fully automated new algorithm called MapPy to pre-process annual Landsat data, including unzipping, stacking, radiometric correction, atmospheric correction, cloud and haze removal, gap filling (Landsat 7), subsetting, and mosaicking. MapPy is a Python library for image processing, feature

extraction, and classification. It depends on various third-party packages and modules (e.g., NumPy, GDAL). If a cloud-free pixel from Landsat observations is not available for an entire year, it uses clear pixels from either the previous or a preceding year. (Annual mosaicking does not impact evergreen mangrove forest discrimination.) MapPy uses tidal information to identify data for low-tide and high-tide periods. The subsetting step involves selecting areas where mangroves are likely to occur and excluding areas where they are not found (i.e., far inland, highlands, and open ocean). Subsetting reduces data volume and increases overall mangrove classification accuracy by reducing the spectral variation imposed by other land cover types.

We will use three different techniques to classify the annual mosaic from 1985 to the present: Random Forest (RF) classifier, Continuous Change Detection and Classification (CCDC) (Zhu and Woodcock 2014, and Change Vector Analysis – Decision Tree Classification (CVA-DTC). **RF classifier** is an ensemble classifier that produces multiple decision trees using a randomly selected subset of training samples and variables. This classifier has become popular within the remote sensing community due to the accuracy of its classifications. It is well-described in many publications. We will use the RF classification algorithm to classify mangrove cover annually from 1985 to the present, followed by the application of an annual temporal filter to remove illogical land-cover transitions. **CCDC** is a new algorithm (based on data-driven thresholds derived from all Landsat bands. Land cover change is identified once the difference between observed and predicted reflectance values exceeds the threshold three consecutive times. The land-cover change information is used to derive a land cover map. **CVA-DTC** is a new Landsat-based change analysis method. It includes image pre-processing, image normalization, calculation of change vectors, and segregation of change vectors to determine areas of change and no-change, training data sampling, land cover classification, and post-classification editing (Fig. 2).

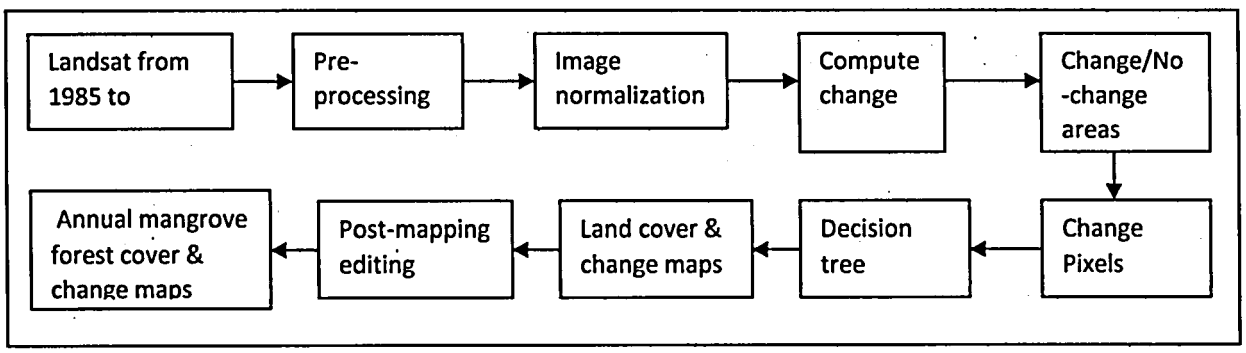

Figure 2: Flow-chart of Change Vector Analysis – Decision Tree Classification (CVA-DTC), one of the three techniques we will use to classify the annual mosaic.

The main goal is to characterize and summarize mangrove forest dynamics over time based upon the observed temporal trajectory of a spectral variable. We will also use a host of indices (e.g., NDVI) calculated from different algebraic manipulations of the original spectral bands and their derivatives. Our work will

demonstrate and verify the utility of disturbance and recovery metrics derived from annual Landsat time series mosaics for classifying annual mangrove cover.

Comparisons of the three classification approaches will be performed using interpreted high resolution (<5 m resolution) satellite data for four sites: the Indus Delta (Pakistan), Goa (India), the Irrawaddy Delta (Myanmar), and the Sundarbans (Bangladesh and India). We will conduct in-depth field surveys at the same sites. We selected these sites based on our prior studies (e.g., in the Indus Delta (Fig. 2)) and the involvement of local collaborators. The surveys will record spatial information on such features as as presence and absence of mangrove forest cover, species composition, and density using GPS. Historical information on the distribution and dynamics of mangrove forests at these sites will be collected from local authorities.

Published data and literature will be used to evaluate performance of the algorithms in other areas. In particular, we will use the mangrove data generated by Giri et al. A two-step validation approach will be adopted: qualitative and quantitative. As a qualitative check, we will divide the entire area into 500 x 500 m regularly spaced grids and check each grid visually to identify and correct any gross errors inherent in the classification maps. Next, we will generate an error matrix (overall accuracy, users and producers accuracies, kappa coefficient, etc.) for the 2017 classification using an interpretation database prepared using very high resolution imagery.Stratified random sampling will be used to generate and interpret 500 sample points each for mangrove and non-mangrove areas. Visual interpretation will be performed. This will be supplemented by our high resolution interpretation of the four sites, mentioned earlier.

The most accurate classification results will be used for further analysis, including annual mangrove change analysis to identify the rates, patterns, and causes of mangrove cover conversion, disturbance, and regrowth.

Task 2: The contractor will review Sensor related peer-review publications that involves literature review of recent work that can be collected from online resources such as web of science, google scholar etc. The specific questions to be asked include what is the state of science in sensor technology, what can be measured with reasonable accuracy, what are the problems and constraints, and what is the future directions?

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

High end desktop computer with commercial software such as ERDAS Imagine will be provided to the contractor. No instruments or equipments are expected from the contractor.

QUALITY ASSURANCE

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.

DELIVERABLES

Major deliverables include an operational methodology to detect and monitor mangrove cover dynamics at a national level on an annual basis; (ii) a comprehensive database of mangrove cover change (deforestation and other disturbance, regrowth, recovery) on an annual basis from 1985 to the present; (iii) estimation of carbon stock changes; and (iv) a review manuscript on sensor technology

SCHEDULE of DELIVERABLES

Major deliverables	*2018*	*2019*	*2020*
Develop and test methodology for annual mapping and monitoring	X		
Complete annual database on mangrove cover change and change analysis		X	
Estimate carbon stocks, and changes in carbon stocks			X
Review paper on sensor technology	X		

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-126

☐ 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 2	Mangrove Monitoring & Sensor R

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 04/01/2017 To 03/31/2018

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 03/31/2018 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: Andrea Clements (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-1363 FAX Number:	
Project Officer Name: Melissa Revely-Wilson (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-0207 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: Mangrove Monitoring & Sensor Review

WA #: 2-126 WACOR: Ron Williams

Contract #: EP-C-15-008 Alternate WACOR: Andrea Clements

The purpose of this PWS Amendment is to completely replace all previous versions of this PWS in full. As a result, this PWS Amendment renders all previous PWS' for this Work Assignment obsolete.

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

SUMMARY OF OBJECTIVES

Scientific understanding of the rates, patterns, and causes of changes in mangrove cover, and the impacts of such changes on ecosystem services, is limited. To help fill this gap, we propose to examine the dynamics of mangrove forests from 1985 to present—this will help assess the consequences for two globally important ecosystem services, carbon sequestration and biodiversity conservation. To do this, we will integrate research in remote sensing, conservation biology, and environmental economics.

Overall goal is to use previously established tools, algorithms, and methods to map and monitor mangroves in South Asia, Pine Islands (Bahamas), and Puerto Rico.

Specific objectives for this performance period are:

Objective 1: use an existing methodology for mapping of mangrove cover in South Asia for the year 2017, and Pine Islands (Bahamas) for the year 2015/16.

Objective 2: Initiate mapping of Puerto Rico for the year 2017

Objective 3: Initiate annual monitoring of mangroves in South Asia and Puerto Rico from 1985 to present.

Recent advances in low-cost sensor technologies for air, water, and land quality are inspiring environmental scientists and the general public to experiment with these devices. Potential uses for new air sensor technologies include measuring local air quality for personal and community environmental health concerns and science education, locating costly leaks at industrial facilities, participating in citizen science, conducting research, and supplementing air quality measurements for regulatory compliance. Initial technical evaluations of these new devices are promising for a variety of needs. Rapid developments coupled with keen interest in the new technologies and accessible data have the potential to soundly transform future environmental monitoring. To keep abreast of this emerging technology, our objective will be to:

Objective 4: Review sensor technologies to measure and monitor air, water, and land quality

BACKGROUND

Remaining global mangrove areas comprise 137,760 square kilometers, spanning 118 countries and territories in the tropical and subtropical regions of the world. They are among the world's most threatened and rapidly declining ecosystems.

However, our scientific understanding of the rates, patterns, causes, and consequences of mangrove change is limited. With the availability of remote sensing technology, it is now possible to map and monitor mangroves on an annual basis.

Mangroves are highly productive ecosystems that store more carbon than any other tropical ecosystem per unit of area. They have a mean whole-ecosystem carbon stock (i.e., above-ground plus below-ground) of 956 t C ha^{-1}, compared to 142 t C ha^{-1} for seagrasses, 241 t C ha^{-1} for tropical rain forests, 408 t C ha^{-1} for peat swamps, and 593 t C ha^{-1} for salt marshes. Soil carbon constitutes approximately 75% of the mangrove carbon pool. Although mangroves occupy less than 1% of global coastal area, they contribute 10–15% (24 Tg C y^{-1}) to coastal sediment carbon storage and export 10–11% of total particulate terrestrial carbon to the ocean.

Mangroves' disproportionate contribution to carbon storage is now perceived as a means and justification for enhanced conservation and restoration and a way to help mitigate greenhouse gas emissions. The best available estimates indicate that 0.15–1.02 Pg (billion) tons of carbon dioxide are being released from mangroves annually due to deforestation and forest degradation, causing economic damages of US$6–42 billion annually. The magnitudes of carbon stocks, carbon stock variability, and changes in carbon stocks in mangroves are still active and contested areas of research, however, with uncertainty in the estimation of deforestation, degradation, and carbon stock changes in mangroves remaining very high. Reliable annual estimates of deforestation, forest degradation, and associated carbon stock changes are needed at a national scale to support inclusion of mangroves in the United Nations Collaborative Program on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD+), as well as to advance NASA's Carbon Monitoring System research. Development of a prototype Monitoring Reporting and Verification (MRV) system for mangroves in developing countries is urgently needed to generate transparent estimates that achieve the levels of accuracy and precision required by current UNFCCC guidance. In the absence of such information, the blue carbon market will be slow to emerge, as investors in

carbon sequestration projects demand a high level of certainty about project quality.

Similarly, recent advances in low-cost sensor technologies for air, water, and land quality are becoming extremely useful for scientists and the general public to measure and monitor air, water, and land quality. Research is being carried out by government, academia, and private sector. Rapid development of this technology in the recent past might provide an opportunity to improve our scientific understanding of air, water, and land quality.

SCOPE

The contractor in this contract period shall work on the study region including coastal mangrove areas in South Asia (Bangladesh, India, Myanmar, Pakistan, and Sri Lanka), Pine Islands (Bahamas), and Puerto Rico.

The second component of the research will involve the review of literature on sensor technologies.

Specific efforts shall include:

- Downloading of satellite data from multiple sources
- Development of 30 meters' mangrove data from Landsat satellite data using software such as ERDAS Imagine.
- Analysis of land cover maps for ecosystem services and sustainability
- GIS (Geographic Information System) processing of data layers
- Quality control of geospatial data
- Creation of metadata and fact sheets supporting the data products
- Literature review on sensor technology

The contractor shall separate the cost by task to provide EPA an understanding of the hours being estimated for each task

TECHNICAL APROACH/OBJECTIVES

Task 1: The contractor shall map mangroves for three regions: South Asia, Pine Islands (Bahamas), and Puerto-Rico. This will improve upon the contemporary remote sensing methods developed by EPA's previous research, which mapped and monitored mangroves on a periodic basis (i.e., every 5–10 years). These previous studies generated data on the distribution, density, and species composition of mangrove forests from local to global scales. Landsat data are available and suitable for the annual analysis in this study. The contractor will use high resolution satellite data such as GeoEye and WorldView (available from the National Geospatial Agency, restricted use). The EPA will provide these datasets to the contractor for training and validation purposes. Other ancillary data such as SRTM 30 m DEM and forest inventory data will also be used. The contractor will generate

information on deforestation (i.e., mangroves converted to other land uses), degradation (i.e., mangroves remain but have reduced density), and regrowth.

EPA has developed and tested a fully automated new algorithm called MapPy to pre-process annual Landsat data, including unzipping, stacking, radiometric correction, atmospheric correction, cloud and haze removal, gap filling (Landsat 7), subsetting, and mosaicking. MapPy is a Python library for image processing, feature extraction, and classification. It depends on various third-party packages and modules (e.g., NumPy, GDAL). If a cloud-free pixel from Landsat observations is not available for an entire year, it uses clear pixels from either the previous or a preceding year. (Annual mosaicking does not impact evergreen mangrove forest discrimination.) MapPy uses tidal information to identify data for low-tide and high-tide periods. The subsetting step involves selecting areas where mangroves are likely to occur and excluding areas where they are not found (i.e., far inland, highlands, and open ocean). Subsetting reduces data volume and increases overall mangrove classification accuracy by reducing the spectral variation imposed by other land cover types.

The contractor will use three different techniques to classify the annual mosaic of Landsat satellite data available from USGS or Google Earth Engine sites: Random Forest (RF) classifier, Continuous Change Detection and Classification (CCDC) (Zhu and Woodcock 2014, and Change Vector Analysis – Decision Tree Classification (CVA-DTC). RF classifier is an ensemble classifier that produces multiple decision trees using a randomly selected subset of training samples and variables. This classifier has become popular within the remote sensing community due to the accuracy of its classifications. It is well-described in many publications. The contractor will use the RF classification algorithm to classify mangrove cover annually from 1985 to the present, followed by the application of an annual temporal filter to remove illogical land-cover transitions. CCDC is a new algorithm (based on data-driven thresholds derived from all Landsat bands. Land cover change is identified once the difference between observed and predicted reflectance values exceeds the threshold three consecutive times. The land-cover change information is used to derive a land cover map. CVA-DTC is a new Landsat-based change analysis method. It includes image pre-processing, image normalization, calculation of change vectors, and segregation of change vectors to determine areas of change and no-change, training data sampling, land cover classification, and post-classification editing (Fig. 2).

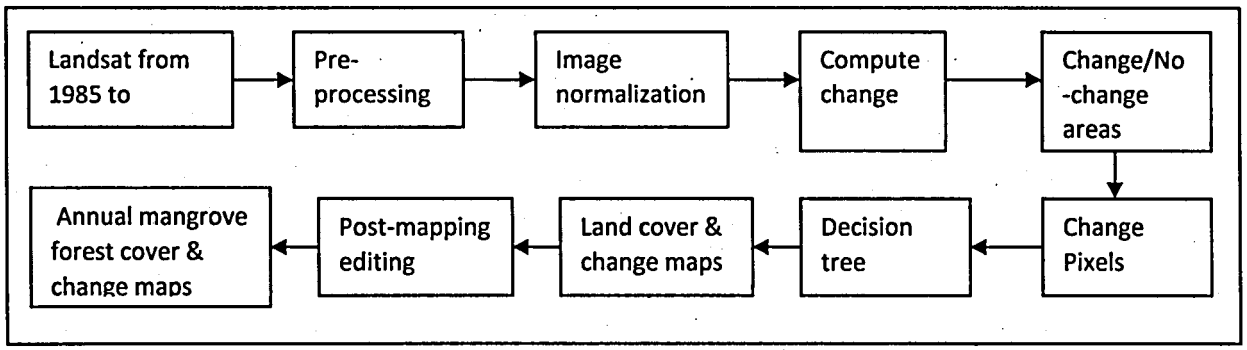

Figure 2: Flow-chart of Change Vector Analysis – Decision Tree Classification (CVA-DTC), one of the three techniques we will use to classify the annual mosaic.

The main goal of the effort shall be to characterize and summarize mangrove forest dynamics over time based upon the observed temporal trajectory of a spectral variable. The contractor shall also use a host of indices (e.g., NDVI) calculated from different algebraic manipulations of the original spectral bands and their derivatives. The work shall demonstrate and verify the utility of disturbance and recovery metrics derived from annual Landsat time series mosaics for classifying annual mangrove cover.

Comparisons of the three classification approaches shall be performed using interpreted high resolution (<5 m resolution) satellite data for four sites: the Indus Delta (Pakistan), Goa (India), the Irrawaddy Delta (Myanmar), and the Sundarbans (Bangladesh and India). The contractor shall conduct in-depth field surveys at the same sites. These sites were selected based on prior EPA studies (e.g., in the Indus Delta (Fig. 2)) and the involvement of local collaborators. The surveys shall record spatial information on such features as presence and absence of mangrove forest cover, species composition, and density using GPS. Historical information on the distribution and dynamics of mangrove forests at these sites shall be collected from local authorities.

Published data and literature shall be used to evaluate performance of the algorithms in other areas. In particular, we will use the mangrove data generated by Giri et al. A two-step validation approach will be adopted: qualitative and quantitative. As a qualitative check, the Contractor shall divide the entire area into 500 x 500 m regularly spaced grids and check each grid visually to identify and correct any gross errors inherent in the classification maps. Next, the Contractor shall generate an error matrix (overall accuracy, users and producers accuracies, kappa coefficient, etc.) for the 2017 classification using an interpretation database prepared using very high resolution imagery. Stratified random sampling will be used to generate and interpret 500 sample points each for mangrove and non-mangrove areas. Visual interpretation will be performed. This will be supplemented by high resolution interpretation of the four sites, mentioned earlier.

The most accurate classification results shall be used for further analysis, including annual mangrove change analysis to identify the rates, patterns, and causes of mangrove cover conversion, disturbance, and regrowth.

Task 2: The contractor shall review sensor related peer-review publications that involves literature review of recent work that can be collected from online resources such as web of science, google scholar etc. The specific questions to be asked include what is the state of science in sensor technology, what can be measured with reasonable accuracy, what are the problems and constraints, and what is the future directions?

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

High end desktop computer with commercial software such as ERDAS Imagine will be provided to the contractor. No instruments or equipment are expected from the contractor.

QUALITY ASSURANCE

The contractor shall develop an WA COR-approved QAPP associated with the literature review and task 2. The Contractor shall be provided a QAPP that shall be used in the performance of task 1 efforts.

DELIVERABLES

For this contract period, specific major deliverables provided by the contractor include: (1) mapping of mangrove forests of South Asian countries for the year 2017. (ii) mapping of pine islands (Bahamas) for the year 2015/16, (iii) initiate mapping of Puerto Rico for the year 2017, (iv) initiate annual monitoring of mangrove in South Asia and Puerto Rico from 1985 to present, and (iv) a review manuscript on sensor technology. JTI shall provide a QAPP for the sensor literature review. EPA will provide a QAPP on or about August 31st for the mangrove monitoring and mapping-related efforts.

SCHEDULE of DELIVERABLES

Major deliverables	*Deadline*
Provide draft products for EPA review and comment on the mapping of mangroves of South Asian countries, and Pine Island.	3/1/2018
Complete mapping of mangroves of South Asian countries for the year 2017	*3/31/2018*
Complete mapping of Pine Islands (Bahamas) for the year 2015/16	*3/31/2018*
Initiate mapping of mangrove in Puerto Rico and annual mapping of South Asian countries and Puerto Rico	*3/31/2018*
Provide a QAPP in support of the sensor literature review	9/30/2017

Provide a draft paper on sensor technology for EPA review and comment	3/1/2018
Provide a final version of the sensor technology literature review paper	3/31/2018

The contractor must separate the cost by task to provide EPA a better understanding of the hours being estimated for each task.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-126

☐ Other ☒ Amendment Number: 000002

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018
Base Option Period Number 2

Title of Work Assignment/SF Site Name: Mangrove Monitoring & Sensor R

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 04/01/2017 To 03/31/2018

Comments:
This Amendment appoints Chandra Giri as the primary WACOR, who replaces Ron Williams. All other terms and conditions remain unchanged.

☐ 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: Chandra Giri
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-4639
FAX Number:

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

Other Agency Official Name: Keith Pfeffer
(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:

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-126

☐ Other ☒ Amendment Number: 000003

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018
Base Option Period Number 2

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 04/01/2017 To 03/31/2018

Comments:
The purpose of this amendment is to revise the PWS. A Work Plan is due within 20 calendar 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: Chandra Giri
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-4639
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: Keith Pfeffer
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Performance Work Statement

WA Title: Mangrove Monitoring & Sensor Review

WA #: 2-126 WACOR: Chandra Giri (Replaces Ron Williams)

Contract #: EP-C-15-008 Alternate WACOR: Andrea Clements

The purpose of this PWS Amendment is to completely replace all previous versions of this PWS in full. As a result, this PWS Amendment renders all previous PWS' for this Work Assignment obsolete.

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

SUMMARY OF OBJECTIVES

Scientific understanding of the rates, patterns, and causes of changes in mangrove cover, and the impacts of such changes on ecosystem services, is limited. To help fill this gap, we propose to examine the dynamics of mangrove forests from 1985 to present—this will help assess the consequences for two globally important ecosystem services, carbon sequestration and biodiversity conservation. To do this, we will integrate research in remote sensing, conservation biology, and environmental economics.

Overall goal is to use previously established tools, algorithms, and methods to map and monitor mangroves in South Asia, Pine Islands (Bahamas), and Puerto Rico.

Specific objectives for this performance period are:

Objective 1: use an existing methodology for mapping of mangrove cover in South Asia for the year 2017, and Pine Islands (Bahamas) for the year 2015/16.

Objective 2: Initiate mapping of Puerto Rico for the year 2017

Objective 3: Initiate annual monitoring of mangroves in South Asia and Puerto Rico from 1985 to present.

Recent advances in low-cost sensor technologies for air, water, and land quality are inspiring environmental scientists and the general public to experiment with these devices. Potential uses for new air sensor technologies include measuring local air quality for personal and community environmental health concerns and science education, locating costly leaks at industrial facilities, participating in citizen science, conducting research, and supplementing air quality measurements for regulatory compliance. Initial technical evaluations of these new devices are promising for a variety of needs. Rapid developments coupled with keen interest in the new technologies and accessible data have the potential to soundly transform

future environmental monitoring. To keep abreast of this emerging technology, our objective will be to:

Objective 4: Review sensor technologies to measure and monitor air, water, and land quality

BACKGROUND

Remaining global mangrove areas comprise 137,760 square kilometers, spanning 118 countries and territories in the tropical and subtropical regions of the world. They are among the world's most threatened and rapidly declining ecosystems.

However, our scientific understanding of the rates, patterns, causes, and consequences of mangrove change is limited. With the availability of remote sensing technology, it is now possible to map and monitor mangroves on an annual basis. Thus characterization and mapping of mangroves is needed to monitor deforestation, degradation, and forest growth.

Mangroves are highly productive ecosystems that store more carbon than any other tropical ecosystem per unit of area. They have a mean whole-ecosystem carbon stock (i.e., above-ground plus below-ground) of 956 t C ha^{-1}, compared to 142 t C ha^{-1} for seagrasses, 241 t C ha^{-1} for tropical rain forests, 408 t C ha^{-1} for peat swamps, and 593 t C ha^{-1} for salt marshes. Soil carbon constitutes approximately 75% of the mangrove carbon pool. Although mangroves occupy less than 1% of global coastal area, they contribute 10–15% (24 Tg C y^{-1}) to coastal sediment carbon storage and export 10–11% of total particulate terrestrial carbon to the ocean.

Mangroves' disproportionate contribution to carbon storage is now perceived as a means and justification for enhanced conservation and restoration and a way to help mitigate greenhouse gas emissions. The best available estimates indicate that 0.15–1.02 Pg (billion) tons of carbon dioxide are being released from mangroves annually due to deforestation and forest degradation, causing economic damages of US$6–42 billion annually. The magnitudes of carbon stocks, carbon stock variability, and changes in carbon stocks in mangroves are still active and contested areas of research, however, with uncertainty in the estimation of deforestation, degradation, and carbon stock changes in mangroves remaining very high. Reliable annual estimates of deforestation, forest degradation, and associated carbon stock changes are needed at a national scale to support inclusion of mangroves in the United Nations Collaborative Program on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD+), as well as to advance NASA's Carbon Monitoring System research. Development of a prototype Monitoring

Reporting and Verification (MRV) system for mangroves in developing countries is urgently needed to generate transparent estimates that achieve the levels of accuracy and precision required by current UNFCCC guidance. In the absence of such information, the blue carbon market will be slow to emerge, as investors in carbon sequestration projects demand a high level of certainty about project quality.

EPA received special request to not only to map mangroves but all major land cover types in the Pine Islands. This is needed to better understand general land use land cover change in these four islands.

Similarly, recent advances in low-cost sensor technologies for air, water, and land quality are becoming extremely useful for scientists and the general public to measure and monitor air, water, and land quality. Research is being carried out by government, academia, and private sector. Rapid development of this technology in the recent past might provide an opportunity to improve our scientific understanding of air, water, and land quality.

SCOPE

The contractor in this contract period shall work on the study region including coastal mangrove areas in South Asia (Bangladesh, India, Myanmar, Pakistan, and Sri Lanka), Pine Islands (Bahamas), and Puerto Rico.

The second component of the research will involve the review of literature on sensor technologies.

Specific efforts shall include:

- Downloading of satellite data from multiple sources
- Development of 30 meters' mangrove data from Landsat satellite data using software such as ERDAS Imagine.
- Developing land cover classification system for Pine Islands
- Analysis of land cover maps for ecosystem services and sustainability
- GIS (Geographic Information System) processing of data layers
- Quality control of geospatial data
- Creation of metadata and fact sheets supporting the data products
- Literature review on sensor technology

The contractor shall separate the cost by task to provide EPA an understanding of the hours being estimated for each task

TECHNICAL APROACH/OBJECTIVES

Task 1 (part 1): The contractor shall map mangroves for three regions: South Asia, Pine Islands (Bahamas), and Puerto-Rico.

This will improve upon the contemporary remote sensing methods developed by EPA's previous research, which mapped and monitored mangroves on a periodic basis (i.e., every 5–10 years). These previous studies generated data on the distribution, density, and species composition of mangrove forests from local to global scales. Landsat data are available and suitable for the annual analysis in this study. The contractor will use high resolution satellite data such as GeoEye and WorldView (available from the National Geospatial Agency, restricted use). The EPA will provide these datasets to the contractor for training and validation purposes. Other ancillary data such as SRTM 30 m DEM and forest inventory data will also be used. The contractor will generate information on deforestation (i.e., mangroves converted to other land uses), degradation (i.e., mangroves remain but have reduced density), and regrowth.

EPA has developed and tested a fully automated new algorithm called MapPy to pre-process annual Landsat data, including unzipping, stacking, radiometric correction, atmospheric correction, cloud and haze removal, gap filling (Landsat 7), subsetting, and mosaicking. MapPy is a Python library for image processing, feature extraction, and classification. It depends on various third-party packages and modules (e.g., NumPy, GDAL). If a cloud-free pixel from Landsat observations is not available for an entire year, it uses clear pixels from either the previous or a preceding year. (Annual mosaicking does not impact evergreen mangrove forest discrimination.) MapPy uses tidal information to identify data for low-tide and high-tide periods. The subsetting step involves selecting areas where mangroves are likely to occur and excluding areas where they are not found (i.e., far inland, highlands, and open ocean). Subsetting reduces data volume and increases overall mangrove classification accuracy by reducing the spectral variation imposed by other land cover types.

The contractor will use three different techniques to classify the annual mosaic of Landsat satellite data available from USGS or Google Earth Engine sites: Random Forest (RF) classifier, Continuous Change Detection and Classification (CCDC) (Zhu and Woodcock 2014, and Change Vector Analysis – Decision Tree Classification (CVA-DTC). RF classifier is an ensemble classifier that produces multiple decision trees using a randomly selected subset of training samples and variables. This classifier has become popular within the remote sensing community due to the accuracy of its classifications. It is well-described in many publications. The contractor will use the RF classification algorithm to classify mangrove cover annually from 1985 to the present, followed by the application of an annual temporal filter to remove illogical land-cover transitions. CCDC is a new algorithm (based on data-driven thresholds derived from all Landsat bands. Land cover change is identified once the difference between observed and predicted reflectance values exceeds the threshold three consecutive times. The land-cover change information is used to derive a land cover map. CVA-DTC is a new Landsat-based change analysis method. It includes image pre-processing, image normalization, calculation of change vectors, and segregation of change vectors to determine

areas of change and no-change, training data sampling, land cover classification, and post-classification editing (Fig. 2).

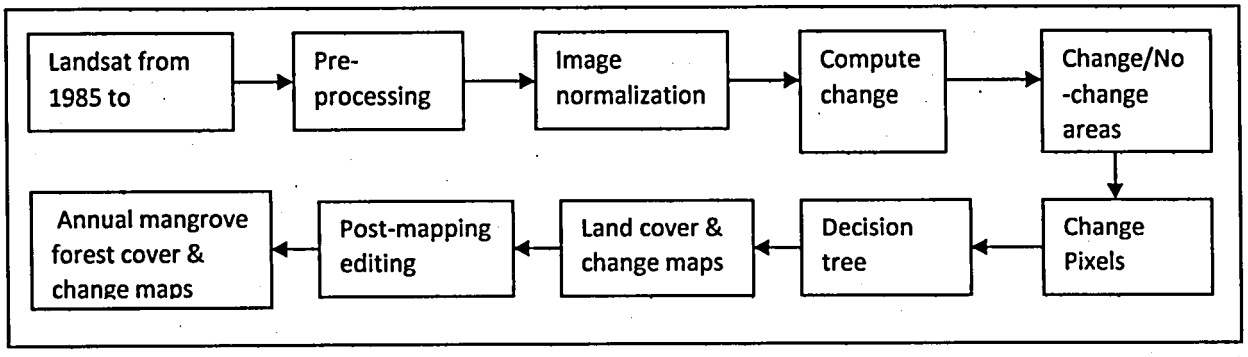

Figure 2: Flow-chart of Change Vector Analysis – Decision Tree Classification (CVA-DTC), one of the three techniques we will use to classify the annual mosaic.

The main goal of the effort shall be to characterize and summarize mangrove forest dynamics over time based upon the observed temporal trajectory of a spectral variable. The contractor shall also use a host of indices (e.g., NDVI) calculated from different algebraic manipulations of the original spectral bands and their derivatives. The work shall demonstrate and verify the utility of disturbance and recovery metrics derived from annual Landsat time series mosaics for classifying annual mangrove cover.

Comparisons of the three classification approaches shall be performed using interpreted high resolution (<5 m resolution) satellite data for four sites: the Indus Delta (Pakistan), Goa (India), the Irrawaddy Delta (Myanmar), and the Sundarbans (Bangladesh and India). The contractor shall conduct in-depth field surveys at the same sites. These sites were selected based on prior EPA studies (e.g., in the Indus Delta (Fig. 2)) and the involvement of local collaborators. The surveys shall record spatial information on such features as presence and absence of mangrove forest cover, species composition, and density using GPS. Historical information on the distribution and dynamics of mangrove forests at these sites shall be collected from local authorities.

Published data and literature shall be used to evaluate performance of the algorithms in other areas. In particular, we will use the mangrove data generated by Giri et al. A two-step validation approach will be adopted: qualitative and quantitative. As a qualitative check, the Contractor shall divide the entire area into 500 x 500 m regularly spaced grids and check each grid visually to identify and correct any gross errors inherent in the classification maps. Next, the Contractor shall generate an error matrix (overall accuracy, users and producers accuracies, kappa coefficient, etc.) for the 2017 classification using an interpretation database prepared using very high resolution imagery. Stratified random sampling will be used to generate and interpret 500 sample points each for mangrove and non-mangrove areas. Visual interpretation will be performed. This will be supplemented by high resolution interpretation of the four sites, mentioned earlier.

The most accurate classification results shall be used for further analysis, including annual mangrove change analysis to identify the rates, patterns, and causes of mangrove cover conversion, disturbance, and regrowth.

Task 1 (part 2) will also include land cover classification of Pine Islands (Bahamas), and perform change analysis of South Asia and Puerto-Rico. This classification will be performed using Google Earth Engine (GEE) graphic user interface and playground. Simple knowledge of Java programming helps but not necessary. GEE will be used to perform land cover classification of Pine Island and change analysis of South Asia and Puerto Rico. Methods explained earlier will be used except for annual change analysis NDVI, band comparisons and other metrics will be compared and contrasted to isolate deforested, degraded, and regrowth pixels.

Task 2: The contractor shall review sensor related peer-review publications that involves literature review of recent work that can be collected from online resources such as web of science, google scholar etc. The specific questions to be asked include what is the state of science in sensor technology, what can be measured with reasonable accuracy, what are the problems and constraints, and what is the future directions?

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

High end desktop computer with commercial software such as ERDAS Imagine will be provided to the contractor. No instruments or equipment are expected from the contractor.

QUALITY ASSURANCE

The contractor shall develop an WA COR-approved QAPP associated with the literature review and task 2. The Contractor shall be provided a QAPP that shall be used in the performance of task 1 efforts.

DELIVERABLES

For this contract period, specific major deliverables provided by the contractor include: (1) mapping of mangrove forests of South Asian countries for the year 2017. (ii) mapping of pine islands (Bahamas) for the year 2015/16, (iii) initiate mapping of Puerto Rico for the year 2017, (iv) initiate annual monitoring of mangrove in South Asia and Puerto Rico from 1985 to present, (v) land cover classification of Pine Island; (vi) annual change analysis of in Pine Islands, South Asia and Puerto Rico; and (iv) a review manuscript on sensor technology. JTI shall provide a QAPP for the sensor literature review. EPA will provide a QAPP on or about August 31st for the mangrove monitoring and mapping-related efforts.

SCHEDULE of DELIVERABLES

Major deliverables	*Deadline*
Provide draft products for EPA review and comment on the mapping of mangroves of South Asian countries, and Pine Island.	3/1/2018
Complete mapping of mangroves of South Asian countries for the year 2017	*3/31/2018*
Complete mapping of Pine Islands (Bahamas) for the year 2015/16	*3/31/2018*
Initiate mapping of mangrove in Puerto Rico and annual mapping of South Asian countries and Puerto Rico	*3/31/2018*
Prepare a draft land cover classification system for Pine Island	3/31/2018
Initiative and training data collection of land cover mapping of Pine Island	3/31/2018
Develop classification approaches for annual mangrove monitoring	3/31/2018
Provide a QAPP in support of the sensor literature review	9/30/2017
Provide a draft paper on sensor technology for EPA review and comment	3/1/2018
Provide a final version of the sensor technology literature review paper	3/31/2018

The contractor must separate the cost by task to provide EPA a better understanding of the hours being estimated for each task.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-128

☐ Other ☐ Amendment Number:

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 2	Tire Crumb Research

Contractor: JACOBS TECHNOLOGY INC.

Specify Section and paragraph of Contract SOW: Section 7 - Database Support

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

Period of Performance: From 11/13/2017 To 03/31/2018

Comments:
A work plan is due within 20 calendar days.

☐ 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 03/31/2018 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 Carry Croghan	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-3184 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 Keith Pfeffer	(Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:

Performance Work Statement

WA Title: Database Support to Tire Crumb Research Study

WA #: 2-128 WACOR: Carry Croghan

Contract #: EP-C-15-008 Alternate WACOR: Peter Egeghy

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

SUMMARY OF OBJECTIVES

The work assignment objective is to provide data programming, data management, documentation, and data analysis support to the research study on synthetic turf fields with tire crumb rubber infill.

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 human exposure and 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 finalized in February 2016. The U.S. EPA and CDC/ATSDR have jointly prepared a peer-reviewed Research Protocol to implement portions of these research activities outlined under the FRAP https://www.epa.gov/chemical-research/research-protocol-collections-related-synthetic-turf-fields-crumb-rubber-infill. A December 2016 status report on the

overall Federal Research Action Plan is available https://www.epa.gov/chemical-research/december-2016-status-report-federal-research-action-plan-recycled-tire-crumb.

SCOPE

Working in close collaboration with EPA, the contractor shall provide on-site support at EPA's facility in Research Triangle Park, North Carolina, for data programming, data management, documentation, and data analysis.

Specific activities include:

1. Code and test programming for loading, cleaning, and combining data.
2. Code and test programming for performing statistical analysis.
3. Modify code from existing programs to accommodate new data inputs.
4. Report issues and concerns immediately to the WACOR or ALT WACOR.
5. Troubleshoot program bugs and issues.
6. Produce documentation on the data processing steps both within program and in external documents.

TECHNICAL APROACH/OBJECTIVES

Contractor staff should have these requisite skills:

1) Fluent in SAS data step and SAS proc SQL.
2) Understanding of SAS macro programming.
3) Knowledge of VBA preferred.

The overall objective is to support data entry, management, and processing that meets EPA Quality Assurance guidelines, in order to produce:

a. Data tables for analysis reporting
b. Graphical representations of data
c. Data structure for statistical analyses
d. Calculations needed for data interpretation and data presentation

In order to accomplish these objectives:

(1) The contractor shall write programs to translate data from various formats into SAS.

(2) The contractor shall write programs to perform data cleaning, combining, and normalizing the data to meet the overall database structure.

(3) The contractor shall write programs that will perform calculation of composite variables.

(4) The contractor shall document all programs and assist in documentation of the entire data processes for the project.

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

N/A.

QUALITY ASSURANCE

Contractor shall adhere to provisions for quality assurance for data management as outlined in the Data Compilation and Analysis Addendum to the EPA's Tire Crumb Research Study (TCRS) Sampling and Analysis QAPP, which is in development. A copy will be made available to the contractor.

DELIVERABLES and SCHEDULE of DELIVERABLES

Task 1: Following approval of the work plan, contractor shall have a kick-off meeting with the WACOR, ALT WACOR, and any other identified EPA staff.

Deliverable 1-1: Scheduled Conference Call.

Schedule: Within 2 business days of work plan approval.

Task 2: Based on provided Technical Direction from the WACOR or ALT WACOR, contractor shall meet with the WACOR or ALT WACOR, either in person or by phone, to discuss technical details of contractor support.

Deliverable 2-1: Scheduled meeting (in person or virtual by mutual agreement).

Schedule: Meeting to be scheduled within 24 hours of Technical Direction.

Task 3: Based on provided Technical Direction from the WACOR or ALT WACOR, contractor shall write a requested program to translate data from a provided format into SAS. Contractor shall provide documentation of the written program.

Deliverable 3-1: Written program for translating data from one format to SAS, with attendant documentation of the program.

Schedule: Within 24 hours of Technical Direction.

Task 4: Based on provided Technical Direction from the WACOR or ALT WACOR, the contractor shall write a program to perform data cleaning, combining, and/or

normalizing to meet the overall database structure. Contractor shall provide documentation of the written program.

Deliverable 4-1: Written program to perform data cleaning, combining, and/or normalizing, with attendant documentation of the program.

Schedule: Within 24 hours of Technical Direction.

Task 5: Based on provided Technical Direction from the WACOR or ALT WACOR, contractor shall write a program to perform calculation of a composite variable. Contractor shall provide documentation of the written program.

Deliverable 5-1: Written program to perform calculation of a composite variable with attendant documentation of the program.

Schedule: Within 24 hours of Technical Direction.

Task 6: Based on provided Technical Direction from the WACOR or ALT WACOR, contractor shall provide a documentation element of an identified data process.

Deliverable 6-1: Documentation element of an identified data process.

Schedule: Within 24 hours of Technical Direction.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-150

☐ Other ☐ Amendment Number:

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 2	

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 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17

☐ 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 03/31/2018 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 Leroy Mickelsen (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-1356 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: Cary Test House LCHP

WA #: 2-150 WACOR: Leroy Mickelsen

Contract #: EP-C-15-008 Alternate WACOR: Shannon Serre

NOTE: This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment # 1-150

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, 2018.

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.

In addition, due to the preparation of coupons in the RTP laboratories, there may be spore contamination in those laboratories. The LCHP will be used to address this situation similar to the test study done in the Cary Test House.

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.

This work will be extended to the coupon preparation laboratory.

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	4/21/17
Submit first draft of test/QA Project Plan (review & concur)	Within 30 days after work plan approval
Revise test/QA Plan amendment per WAM comments	2 weeks after comments received
Submit draft report	30 days after completing data collection
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. HASP and QAPP will be amended to include the coupon prep lab decontamination.

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. One hundred additional BIs and 100 additional settling plates will be added as well as 25 surface samples for evaluation of the coupon prep lab decon.

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,

    The coupon prep lab will be decontaminated once using LCHP.

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 WACOR, 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 WACOR as soon as possible via email and through other agreed upon means. The WACOR 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 informing the WACOR, 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 WACOR 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 WACOR and safety personnel prior to the commencement of any testing. The contractor shall provide a copy of the health and safety plan to the WACOR 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: 2-150

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018
Base Option Period Number 2

Title of Work Assignment/SF Site Name: CARY TEST HOUSE LCHP

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 04/01/2017 To 03/31/2018

Comments:
See attached PWS for highlighted changes. A responsive Work Plan is due within 20 calendar 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: Leroy Mickelsen
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-1356
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: Keith Pfeffer
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

AMENDMENT #2 TO (SEE RED ADDITIONS)
PERFORMANCE WORK STATEMENT (PWS)

Cary Test House Low-Concentration Hydrogen Peroxide Vapor Decontamination Tests

OEM CBRN CMAD
APPCD ON-SITE CONTRACT JACOBS EP-C-~~09-027~~-15-008, WA# 2-150

I. PERIOD OF PERFORMANCE

The period of performance for this work assignment (WA) shall be from April 1, 2015 to March 31, 2017.

II. 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. In addition to the above objective, additional tests beyond the original scope will be added. During these tests there are additional objectives that include but are not limited to:

- Lab decontaminations
- Test house with no ventilation system running
- Test house with both low, then high RH using same concentration and dose of HP
- Test house during summer time with AC on, then with AC off (but HVAC fan on)
- Test house repeat runs for statistical support for conclusions

There will be a need for additional BIs to test the ability of Low-C HP to penetrate into hard to reach areas.

III. 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. There is a need to better understand the variations in possible application of this technology in different situations and there is a need to evaluate the penetration of LCHP into hard to reach areas for each of these different situations.

IV. TECHNICAL APPROACH

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 only the efforts related to conducting the decontamination tests. All microbiological preparation and analyses work will be conducted by the on-site Biolab under a separate work assignment on this same contract. A separate QAPP will be used to handle the laboratory evaluation of LCHP but the other Cary Test House scenarios can be conducted with slight modifications to the existing QAPP and will include additional BIs placed in furniture,

under rugs, in drawers, and other hard to reach places to evaluate the penetration of LCHP.

V. AFFORDABILITY

This effort is labor/time intensive, which is where the bulk of the funding is required. Normal expendable laboratory items are also required for this project. Additional expendable supplies will be needed to complete these additional tasks.

VI. FACILITIES AND MATERIALS

All tasks described in this PWS shall be performed in-house, at the rented Cary House facilities at McDonald Woods, Cary, NC or in the laboratories on Alexander Drive, Durham, NC.

VII. TASKS

No work conducted under this WA shall duplicate work conducted under previous work assignments, unless directed by the WA manager (WAM), and in order to troubleshoot problems from previous work and to assess repeatability (precision) of the data gathered previously. All microbiological preparation and analyses work will be conducted by the on-site Biolab under is work assignment.

The Contractor shall perform the following tasks:

1. Prepare a 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. The QAPP will be amended to include these tasks and an additional QAPP will be written for the laboratory scenarios.

2. Conduct microbiological tasks including the inoculation of coupons, analyze coupons, etc. Estimated at 100 sample coupons per run, for a total of 500 coupons. The number of coupons will be increased to120 and the number of BIs will also be increased to 75 for each additional test.

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 (or laboratory)
    - Prepare house (or laboratory), set up vaporizers, monitor HP concentration in air
    - 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. The laboratory tests and additional test at the Cary Test House will be reported in a separate report from the original work assignment.

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. The Health and Safety Plan will be updated to include the laboratory tests. The additional tests at the Cary Test House are still covered under the original H&S plan with slight modifications as needed for the different environments.

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.

VIII. DELIVERABLE SCHEDULE

The following table outlines the expected schedule that the contractor shall meet for the period covered by this PWS. The schedule assumes a start date of May 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	5/15/15

Submit first draft of test/QA Project Plan	5/21/15
Revise test/QA Plan amendment per WAM comments	2 weeks after comments received
Submit draft report	5/17/17
Submit final report based on comments from WAM	2 weeks after comments received
Revise test/QA plan amendment #2 for WAM comments	2 weeks after receiving amendment
Submit draft report	2/5/18
Submit final report based on comments from WAM	2 weeks after comments received

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 awardee 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 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 at www.epa.gov/guality. 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.

Note: Leroy Mickelsen and Shannon Serre will be the WAMs for this work.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-151

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number 2

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 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17

☐ 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 03/31/2018 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: Leroy Mickelsen
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-1356
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: Desorption of Methyl Bromide from Materials

WA #: 2-151 WACOR: Leroy Mickelsen

Contract #: EP-C-15-008 Alternate WACOR: Shannon Serrie

NOTE: This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment # 1-151

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, 2018.

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 types will be selected by EPA WACOR.

TECHNICAL APROACH/OBJECTIVES

The contractor shall conduct the following tasks:

Task 1. Complete and Approved QAPP and HASP

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 Option Period.

In the QAPP the contractor shall identify 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: To be completed within 30 days of beginning of Option Period 2

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 identified by EPA WACOR, and are:

- Rubber material simulating flooring or gaskets around doors and windows
- Plastic material to simulate interior surfaces of mass transit
- Upholstered foam to simulate seating material

During Task 2 monthly progress reports are required.

Due Date Task 2: Monthly.

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, recommendations, and limitations to the data.

During Task 3 monthly progress reports are required.

Due Date Task 3: March 31, 2018.

WA SPECIFIC EQUIPMENT

None.

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

Monthly reports, and draft and final report.

SCHEDULE of DELIVERABLES

Monthly reports by 20th of every month for the preceding month after QAPP is approved

Draft Report due March 1, 2018.

Final Report due March 31, 2018.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-175

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number: 2

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 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17

☐ 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										
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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: 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: 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 #: 2-175 WACOR: Lewis Weinstock

Contract #: EP-C-15-008 Alternate WACOR: Solomon Ricks

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

SUMMARY OF OBJECTIVES

NOTE: This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment # 1-175.

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 2016 has created a need for new technologies for hourly VOCs, true NO2, carbonyls, and mixing height data using ceilometers. 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, mixing height, 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 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: 2-176

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number 2

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 04/01/2017 To 03/31/2018

Comments:
Work plan due within 20 days of work assignment award.

Accounting and Appropriations Data

☐ Superfund [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 03/31/2018 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 Jenia Tufts
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0371
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: Mega PE and PM2.5 Round Robin Program Sampling, Gravimetric Analysis, and Distribution

WA #: 2-176

WACOR: Jenia Tufts
EPA/OAQPS/AAMG
RTP Mail Code C304-06
919-541-0371

Contract #: EP-C-15-008

Alternate WACOR: Lewis Weinstock
EPA/OAQPS/AAMG
RTP Mail Code C304-06
919-541-3661

PERIOD OF PERFORMANCE

The period of performance detailed in the Performance Work Statement (PWS) shall be from the time of award through March 31, 2018.

SUMMARY OF OBJECTIVES

The objectives of this project are to collect, characterize gravimetrically, and distribute performance evaluation samples to CSN, IMPROVE and PM2.5 FRM Network laboratories and to document the procedures for performing these tasks.

BACKGROUND

The deployment of a PM monitoring network is a critical component in the national implementation of the PM NAAQS. The ambient data from this network drives an array of regulatory decisions, ranging from designating areas as attainment or nonattainment, to developing cost-effective control programs and tracking the progress of such programs. Data derived from the PM monitoring network include both aerosol mass measurements and chemical speciation data. Mass measurements are used principally for PM NAAQS comparison purposes in identifying areas that meet or do not meet PM NAAQS, and in supporting designation as attainment or non-attainment.

Chemical speciation data serve the implementation needs associated with developing emission mitigation approaches to reduce ambient aerosol levels and a variety of research and modeling needs. These measurements also provide support for regional haze assessments. The PM Chemical Speciation Network (CSN) consists of approximately 50 Trends sites for routine speciation monitoring and another 100 or so sites for state/local driven monitoring needs.

The purpose of the annual CSN/IMPROVE analytical Mega Performance Evaluation (PE) Program, and the PM2.5 Round Robin (RR) Program, are to quantitatively evaluate the total measurement system across the Network laboratories and identify any potential biases or problems in the data from these laboratories. Under

this program, each participating Network laboratory is required to analyze a set of PE filter samples that are collected, prepared and characterized by OAQPS.

The analysis of PE samples both addresses interlaboratory comparability and evaluates specific laboratory performance at laboratories routinely analyzing gravimetric and chemical speciation samples for the CSN and IMPROVE networks. Mega PE Program audit samples are collected and distributed one a year, and the PM2.5 RR audit samples are collected and distributed twice per year.

SCOPE

TECHNICAL APROACH/OBJECTIVES

Note: The Contractor shall not publish or present results from this work assignment without prior notification and review by EPA.

The Contractor shall attend regularly scheduled meetings with the EPA WACOR. Initially these meetings will be scheduled on a weekly basis, however the frequency will decrease to twice-monthly or less as determined by project needs.

The Contractor shall provide the following:

TASK 1 – Work Plan, Cost Estimate and Delivery Schedule

The Contractor shall submit a Work Plan, cost estimate and a delivery schedule in accordance with the terms of the contract.

TASK 2 – Shake Down Samplers

The Contractor shall confirm that the 32 channel PM2.5 sampling array currently installed on the mezzanine at the end of Shed Row on the RTP campus collect representative samples across all channels and between samplers. This shall be accomplished by:

1. Comparing flows from each of 32 inlets and adjusting as needed until all 32 inlets achieve a flow within ±5% of each other.
    a. The target flow is 6.7 lpm, however deviations from this flow are acceptable as long as all 32 channels are within 5% of each other.
2. Collecting thirty-two collocated PM2.5 samples onto tared Teflon filters and comparing the results gravimetrically.
    a. This comparison shall be repeated at least twice.
    b. Gravimetric results shall be obtained by using the robotic weighing system located in E485A.
    c. The precision between samplers and channels will be expressed as the percent relative standard deviation (RSD) between samples and will be used to evaluate the reproducibility of $PM_{2.5}$ mass collection across the samplers. If the RSD is not within ±5% the EPA WACOR shall be contacted for troubleshooting the problem.

TASK 3 – Annual Mega PE Sample Collection and Distribution

After the confirmatory tests in Task 2 have been successfully completed, the contractor shall collect $PM_{2.5}$ filter samples using the sampling system from Task 1 and distribute the samples to at least 9 laboratories. For each sampling event, outlined in Table 1, all 32 channels will be loaded with the appropriate filter type (47 mm MTL PTFE, pre-fired 25 mm Quartz fiber, 47 mm Nylon filters or 25 mm PTFE filters). OAQPS will provide the filters to be used in sampling and information on the number of labs receiving samples of each type.

Table 1. Example Sampling Matrix for Annual Mega PE Audit Series

Sampling Event[a]	Filter Type	Filter Samples Collected	Labs Receiving Samples	# Samples per lab	# Samples Archived	Comment
1	25 mm Quartz	32	4	4	16	OC/EC
2	47 mm Teflon	32	5	4	12	Grav
3	25 mm Teflon	32	2	4	24	Grav
4	47 mm Nylon	32	6	4	8	IC
5	47 mm Teflon	32	2	4	24	IC
6	47 mm Teflon	32	5	4	12	XRF

Target PE sample concentrations will be based upon current CSN and IMPROVE Network averages. Sampling durations will be based upon PM2.5 data collected from continuous instrumentation located at the EPA AIRS site.

In addition to loaded filter samples, two filter blanks from the same lots used in each sampling event will be included with all samples submitted to each laboratory for analysis. The Contractor shall be responsible for shipping the samples to participating laboratories. OAQPS will provide the Contractor with the list of laboratories receiving specific sample types and addresses.

For gravimetric Mass Analysis on 47 mm and 25 mm Teflon® filter samples: Samples will be collected onto filters that have been tared by both the Contractor and the relevant Network laboratories, as described in the "Quick Implementation Scheme for Gravimetric PE Samples," which is included as Appendix A to this SOW. Conditioning and weighing methods will follow both 40 CFR, Part 50, Appendix L, and "Quality Assurance Guidance Document 2.12: Monitoring PM2.5 in Ambient Air using Designated Reference or Class I Equivalent Methods." Weights will be obtained using the ORD NERL robotic MTL weighing system located in E485A.

Equipment and supplies required to complete this Task will be purchased as needed after consultation with the WACOR. Examples include, but are not limited to, PetriSlides, filter forceps, laboratory gloves, laboratory coats, Kimwipes, etc.

TASK 4 – Biannual PM2.5 Round Robin Sample Collection and Distribution

Under this Task, the contractor shall collect $PM_{2.5}$ filter samples onto 47 mm MTL PTFE filters using the sampling system from Task 1 and distribute the samples to at least 13 laboratories. Sufficient filter samples will be collected to provide at least 4 loaded filters to each laboratory. For each sampling event, all 32 channels will be loaded with the appropriate filter. OAQPS will provide the filters to be used in sampling.

All samples collected under this Task are for gravimetric analysis. Samples will be collected onto filters that have been tared by both the Contractor and the participating laboratories, as described in the "Quick Implementation Scheme for Gravimetric PE Samples," which is included as Appendix A to this SOW. Conditioning and weighing methods will follow both 40 CFR, Part 50, Appendix L, and "Quality Assurance Guidance Document 2.12: Monitoring PM2.5 in Ambient Air using Designated Reference or Class I Equivalent Methods." Weights will be obtained using the ORD NERL robotic MTL weighing system located in E485A.

Target PE sample concentrations will be based upon current CSN and IMPROVE Network averages. Sampling durations will be based upon PM2.5 data collected from continuous instrumentation located at the EPA AIRS site.

In addition to loaded filter samples, two filter blanks from the same lots used in each sampling event will be included with all samples submitted to each laboratory for analysis. The Contractor shall be responsible for shipping the samples to participating laboratories. OAQPS will provide the Contractor with the list of laboratories receiving specific sample types and addresses.

Equipment and supplies required to complete this Task will be purchased as needed after consultation with the WACOR. Examples include, but are not limited to, PetriSlides, filter forceps, laboratory gloves, laboratory coats, Kimwipes, etc.

TASK 5 –Standard Operating Procedures

Under this Task, the Contractor shall revise existing draft standard operating procedures (SOPs):

- for the operation, maintenance, and flow calibration of the sampling array, and
- for the use and maintenance of the MTL weigh room, and associated robotic weighing system.

Current SOPs requiring revision will be provided by OAQPS.

TASK 6 –Brief Sampling Plan and Monthly Progress Reports

The Contractor shall provide a brief sampling plan with a schedule for the execution of Tasks 3 and 4.

The Contractor shall provide monthly progress reports outlining accomplishments, problems encountered and corrective actions.

INSTRUMENTATION/EQUIPMENT EXPECTATIONS

Meteorological instruments such as temperature/RH and wind velocity measurers.

Sampling timer (for auto cutoff of existing pump).

Miscellaneous sampling supplies.

QUALITY ASSURANCE

The EPA Category I CSN Field quality assurance project plan (QAPP) "*Quality Assurance Project Plan: PM2.5 Chemical Speciation Sampling at Trends, NCore, Supplemental and Tribal Sites*" is the prime document governing CSN site location, sample collection, and QA/QC requirements and encompasses the activities of the EPA OAQPS, EPA Regions and state and local tribes (SLT's.). The CSN Field QAPP ensures the overall quality of data generated by the CSN monitoring network is appropriate for its intended use and covers the activities described in this SOW. The QAPP and supporting documents are posted on EPA's AMTIC website at https://www3.epa.gov/ttn/amtic/specguid.html. Sections 6 and 11 of the QAPP contain information on critical measurements for sampling, shipping requirements, and other information relevant to the Tasks described above.

DELIVERABLES

SCHEDULE of DELIVERABLES

Task	Deliverables	Due Date
1	Work Plan and Cost Estimate	In accordance with the terms of the contract.
2	Shake Down Samplers Results Summary	May 31, 2017
3	Annual Mega PE Sample Collection and Distribution	June 31, 2018
4	Biannual PM2.5 Round Robin Sample Collection and Distribution	July 31, 2017 (Round 1) January 31 2018 (Round 2)
5	Draft Standard Operating Procedures	March 31, 2018
6	Brief Sampling Plan for Tasks 3 and 4 with Schedule	May 31, 2017
6	Monthly Progress Reports	Monthly

Appendix A

Quick Implementation Scheme for Gravimetric PE Samples (Mega PE and $PM_{2.5}$ RR)

Pre-Sampling Activities

- OAQPS
  - Identifies participating labs with coordination from Regions
  - Coordinates implementation scheme with participating labs
- Contractor
  - Obtains tare weights on blank, conditioned filters and metal check weights
    - Approximately 5 filters, including blanks, and 2 check weights per participating lab
  - Sends tared blank filters and metal check weights to participating labs for lab tare weights within 3-5 days of obtaining weights
- Participating labs
  - Obtain tare weights of blank filters and weighs metal check weights
  - Returns filters and weights to Contractor within 3-5 days of receipt
- Contractor
  - Reweighs blank filters and check weights to confirm previous weight and participating lab weight within 3-5 days of receipt
  - Randomly places filters in sampling array and collects PM2.5 under various sampling scenarios

Post-Sampling Activities

- Contractor
  - Equilibrates and obtains final weights on all filters within 3-5 days of sampling
  - Returns filters and check weights to participating laboratories for final weights within 3-5 days of obtaining weights
- Participating labs
  - Obtains final weights for filters within 5-8 days of sample receipt
  - Reweighs checks weights
  - Sends results to OAQPS
  - Returns filters and check weights to Contractor
- Contractor
  - Reweighs filters and check weights to confirm previous weight and participating lab weight within 3-5 days of receipt
  - Alerts OAQPS of any spurious data
  - Summarizes results and provide data summary and raw data to OAQPS
- OAQPS
  - Analyzes data and reports results to EPA Regions and participants
  - Trouble shoots any spurious data
  - Reports final evaluation to AMTIC

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-300

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number: 2

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 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17

☐ 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 03/31/2018 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: 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: Technical Support for NCCT

WA #: 2-300 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, 2018. This work assignment is a follow-on to 1-300.

SUMMARY OF OBJECTIVES

The purpose of this requirement is to obtain contractor support for injection molding and production of four (4) custom polystyrene parts: 96-well lid, 384-well lid, 12-trough plate, and 24-trough plate.

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: Custom Part Production

Per the previous Work Assignment# 1-300, four injection molding tools have been produced – one for each custom polystyrene part (96-well lid, 384-well lid, 12-trough plate and 24-trough plate). The Contractor shall employ these injection molding tools to produce finished parts as specified in the design files previously provided by EPA. The parts will be injection molded from clear, high heat, crystal grade polystyrene (i.e. Styron 666H).

Estimated quantities for each part are listed below:

- 96-well lid: 500 – 3,000
- 384-well lid: 500 – 2,000
- 12-trough plate: 1,500 – 8,000
- 24-trough plate: 1,500 – 5,000

These parts shall be shipped no less than 60 days from receipt of technical direction.

Task 2: Packaging and Sterilization

Following injection molding and receipt at EPA, the 96-well and 384-well lids require no further action by the Contractor.

Following injection molding and receipt at EPA, the 12-trough and 24-trough plates will be individually packaged in a sterilization pouch, and the Contractor will perform ethylene oxide (EtO) sterilization on each part.

The contractor may be required to sterilize between 3,000 and 13,000 trough plates.

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.

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 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 a minimum order of 1) 500 96-well lids; 2) 500 384-well lids; 3) 1500 12-trough plates; and 4) 1500 24-trough plates. Specific quantities shall be provided in technical direction.
2. The Contractor shall deliver 12-trough and 24-trough plates individually packaged in a sterilization pouch, and ethylene oxide (EtO) sterilized. Specific quantities shall be provided in technical direction.

SCHEDULE of DELIVERABLES

1. The Contractor shall respond with a work plan as required by the work assignment.
2. The Contractor shall deliver the minimum order of: 1) 500 96-well lids, 2) 500 384-well lids, 3) 1500 12-trough plates and 4) 1500 24-through plates within 60 days after receipt of technical direction.
3. The Contractor shall deliver 12-trough and 24-trough plates individually packaged in a sterilization pouch, and ethylene oxide (EtO) sterilized within 15 days of receipt of parts.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-300

☐ 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 2	Technical Support for NCCT

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 04/01/2017 To 03/31/2018

Comments:
This amendment is to change the Alt. COR from Sandra Roberts to Danielle Suarez. All other terms and conditions remain unchanged.

☐ 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										
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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 David Murphy	(Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Project Officer Name Melissa Revely-Wilson	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-0207 FAX Number:
Other Agency Official Name Keith Pfeffer	(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:

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-301

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number 2

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 04/01/2017 To 03/31/2018

Comments:
Work Plan due 4/21/17.

☐ 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
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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 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 Laboratory Support

WA #: 2-301 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, 2018. This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment 1-301.

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 2018. 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. Technical direction may include but is not limited to:

- Providing approximately 8 to 10 customized reagents for ongoing or new experiments including transcriptomics and metabolomics
- purchase of equipment necessary to optimize the laboratory space to meet the mission of the NCCT
- design or fabricate special tooling or recommended modifications to the laboratory in support of ongoing projects

Task 2. Laboratory Stand-Up

The contractor shall provide support under this task as outlined in technical direction. Technical direction may include but is not limited to:

- recommend changes to layout and workflow in the lab
- provide recommendations or equipment with regard to safety or experimental optimization

Task 3. Quality Assurance Laboratory Support

The contractor shall provide quality service under this task for approximately 5 to 8 research projects. The support may include development of quality assurance project plans or standard operating procedures. The contractor may also be required to provide an overall quality management plan for the lab. The specific details for quality requirements will be provided on an individual basis by the corresponding principal investigator.

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 manuscript reviews for approximately 6 to 8 journal articles. Each journal article will be reviewed for scientific content, grammar, and style. The contractor shall provide a document reviewed and tracked changes for each journal article.

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: 2-301

☐ 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 2	NCCT Lab Stand Up

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 04/01/2017 To 03/31/2018

Comments:
This amendment is to change the Alt. COR from Sandra Roberts to Danielle Suarez. All other terms and conditions remain unchanged.

☐ 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: 04/01/2017 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 David Murphy	(Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Project Officer Name Melissa Revely-Wilson	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-0207 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: 2-301

☐ Other ☒ Amendment Number: 000002

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 2	NCCT Lab Stand Up

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 04/01/2017 To 03/31/2018

Comments:
This Amendment issues the changes highlighted in the attached PWS, in accordance with attached Technical Direction #12. All other terms and conditions remain unchanged.

☐ 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										
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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 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 Keith Pfeffer (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: NCCT Laboratory Support

WA #: 2-301 WACOR: David Murphy

Contract #: EP-C-15-008 Alternate WACOR: Sandra Roberts

Amendment 2 -- Revised to include Technical Direction 12 (attached) to include Rat S9.

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, 2018. This work assignment is a follow-on to work performed in Option Period 1 under Work Assignment 1-301.

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.

Technical Direction 12 – The contractor shall deliver a Custom Lot of Aroclor-1254 Induced Sprague Dawley Rat Liver S9 (Post Mitochondrial Supernatant) in accordance with the attached Technical Direction document.

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 2018. 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.

Technical Direction 12 – Custom Lot of Aroclor-1254 Induced Sprague Dawley Rat Liver S9 (Post Mitochondrial Supernatant) in accordance with the attached Technical Direction document.

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: 2-302

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number: 2

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 04/01/2017 To 03/31/2018

Comments:
Work plan due 4/21/17

☐ 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 03/31/2018 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: 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 #:	2-302	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, 2018. This work assignment is a follow-on to work performed in option period 1 under Work assignment 1-302

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 management system with a master and multiple replicas, PostgreSQL databases and a MongoDB cluster to support all of NCCT scientific application development and research.

The contractor shall provide full-time support and be co-located on-site with NCCT developers. The contractor 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 full-time 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 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
13. Develop and manage bioinformatics and data analysis pipelines

SPECIFIC TASKING AREAS

Task 1 – Data Management Systems Support

The contractor shall design, configure, implement and document a MySQL Master DBMS with multiple Replicas utilizing MySQL Enterprise Edition DBMS as described by the makers of said product. (Product description located: https://www.mysql.com/products/enterprise/). 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, if the need arises.

Subtask 1.1 – MySQL Cluster CGE Implementation

The contractor shall install and configure MySQL Enterprise Edition in a Master with multiple Replicas configuration across several nodes already procured by NCCT. The DMBSs 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. The Contractor shall 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. The Contractor shall 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

Task 4 – Bioinformatics Support

The contractor shall provide support in developing and managing bioinformatics and data analysis pipelines, including but not limited to database development and administration, statistical software programming (e.g., R), and bioinformatics techniques for analyzing diverse and, often, heterogeneous biological data. The contractor will support multiple research projects under EPA's Chemical Safety for Sustainability Research Program, including data management, integration, and analysis of ToxCast high-throughput screening data and the development and management of data and analysis pipelines from high-throughput transcriptomics and toxicogenomics experiments.

Subtask 4.1 – Toxicogenomics and High-Throughput Sequencing Bioinformatics Support

The contractor shall design and develop data management and analysis pipelines for large-scale concentration-response toxicogenomics data in collaboration with existing NCCT staff including, but not limited to, NCCT's Product Owners and Subject Matter Experts as well as existing on-site bioinformaticians. The contractor shall develop a database infrastructure for storing terabytes of sequencing and post-alignment data. The contractor shall develop or further develop custom data analysis pipelines for processing, analyzing and interpreting the complex and large concentration-response toxicogenomic data.

Contractor personnel must possess expertise in the following technologies:

1. MySQL and other potential database platforms
2. R (statistical programming language)
3. Perl
4. Python
5. Git Version Control System
6. Other open source tools and technologies as advised by NCCT staff

Subtask 4.2 – High-throughput Screening (e.g., ToxCast) Data Management & Analysis Support

The contractor shall manage, maintain and extend the ToxCast Data Analysis Pipeline (tcpl), as implemented in R and available on CRAN and GitHub. The contractor shall manage incoming ToxCast data streams and work with NCCT staff and other Subject Matter Experts to optimally analyze the data. The contractor shall also work with NCCT staff and Subject Matter Experts to appropriately annotate and maintain annotation of the hundreds of ToxCast assays. Therefore, the contractor shall have a working knowledge of high-throughput screening technologies to aid in the appropriate handling of the data, identification of potential data quality issues, and the appropriate descriptions of the assay systems.

Contractor personnel must possess expertise in the following technologies:

1. MySQL
2. R (statistical programming language)
3. Git Version Control System
4. 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 use the QAPP that was developed under work assignment 1-302 for this work assignment.

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.

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 Enterprise Edition 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
Task 4: Bioinformatics Support	Design and development of the data management and analysis pipelines for large-scale concentration-response toxicogenomics data; and provide management, maintainenance and extend the ToxCast Data Analysis Pipeline (tcpl).

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 Enterprise Edition with ne Master and multiple Replicas
- Migrate existing SQL databases into the new MySQL Enterprise Edition
- 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

Task 4: As indicated in each Technical Directive issued. Deliverables for task 3 may include:

- Design and develop data management pipelines
- Develop database infrastructure for storing sequencing and post-alignment data
- Develop custom data analysis pipelines for processing, analyzing and interpreting concentration response toxicogenomic data
- Manage, maintain, and extend the ToxCast Data Pipeline
- Annotate and maintain annotation of hundreds of ToxCast assays

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-302

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-008

Contract Period: 04/01/2015 To 03/31/2018

Base Option Period Number: 2

Title of Work Assignment/SF Site Name: NCCT Application and Data Supp

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 04/01/2017 To 03/31/2018

Comments:
Task 5 ¿ Intermediate.Web Developer

☐ 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 03/31/2018 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: David Murphy
(Signature) (Date)
Branch/Mail Code:
Phone Number:
FAX Number:

Project Officer Name: Melissa Revely-Wilson
(Signature) (Date)
Branch/Mail Code:
Phone Number: 919-541-0207
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: NCCT Application and Data Support

WA #: 2-302 Amendment 1 WACOR: David Murphy

Contract #: EP-C-15-008 Alternate WACOR: Sandra Roberts

Revised June 2017 to add Task 5

Task 5 – Intermediate Web Developer

The contractor shall provide web development 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. The participant will support the design, development, programming, testing and maintenance of multiple front end applications requiring access to chemical and biology data.

Subtask 5.1 – Development of Web Applications

The participant will assist in the design, coding and testing of technical user interface/UX development solutions 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. They will work closely with other members of NCCT team to create new and exciting web-based applications. The programs will be custom self-contained, database driven web applications, utilizing modularity and code re-use principals. They will participate in maintenance and upgrades to existing websites and applications. They will participate in team code reviews. The use of analytical and critical thinking skills will be needed for troubleshooting and applying solutions. They will need to gather and refine specifications and requirements based on technical needs. To improve productions, the participant will need to apply knowledge of industry trends and emerging technologies.

Subtask 5.2 – Development of Frontend Web Components

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 multiple Red Hat Enterprise Linux Servers. 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. Contractor should have a degree in computer science, information science or a related field of study, from an accredited university or college.
2. 3-5 years of Web Development experience

3. Exhibits provicincy in HTML, CSS, JavaScript, Ruby 4.x, Vue.js
4. Experience with jQuery and AJAX
5. Demonstrates basic knowledge of object and component design methodologies and technologies.
6. Familiarity with server-side MVC web frameworks
7. Possesses basic knowledge of classes, components, objects and interfaces
8. Awareness of cross-browser compatibility issues and client-side performance considerations
9. Understanding of full web-stack – from server to browser
10. Experienced with command line interface on Linux operating system
11. Familiar with Agile Scrum Methodology
12. Understands basic relational database concepts (MySQL and PostgreSQL) NoSQL is a plus.
13. Knowledge Git Version Control System
14. Other open source tools and technologies as advised by NCCT staff

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 5: Develop dashboard web applications and frontend application code	Combine appropriate tools and data sources (via web sources) to deliver complete dashboard solutions. Provide quality support to the design, document, development, programming, testing and maintenance of multiple front end applications. Continuous completion of stories/bugs in multiple projects and deployed within NCCT multiple software application environments.

Task 5: As indicated in each Technical Directive issued. Deliverables for task 4 may include:

- Implement and document web-based Dashboard utilizing existing and new data
- Migrate existing dashboard applications into Vue.js
- Complete stories/bugs pertaining to web-based applications in multiple projects.
- Implement modular component strategies utilizing existing and new toolsets.
- Integrate existing data as well as new data within newly designed components
- Create unit, integration and acceptance tests for all modified code for quality assurance.
- Gather and document requirements based on technical needs.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 2-302

☐ Other ☒ Amendment Number: 000002

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 2	NCCT Application and Data Supp

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 04/01/2017 To 03/31/2018

Comments:
Adding new tasks 6 and 7. All other terms and conditions remain unchanged.

☐ 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										
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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 David Murphy	(Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:
Project Officer Name Melissa Revely-Wilson	(Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-0207 FAX Number:
Other Agency Official Name Keith Pfeffer	(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: NCCT Application and Data Support

WA #: 2-302 WACOR: David Murphy

Contract #: EP-C-15-008 Alternate WACOR: Sandra Roberts

Revised August 2017 to add tasks 6 and 7

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, 2018. This work assignment is a follow-on to work performed in option period 1 under Work assignment 1-302

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 management system with a master and multiple replicas, 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 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
13. Develop and manage bioinformatics and data analysis pipelines

SPECIFIC TASKING AREAS

Task 1 – Data Management Systems Support

The contractor shall design, configure, implement and document a MySQL Master DBMS with multiple Replicas utilizing MySQL Enterprise Edition DBMS as described by the makers of said product. (Product description located: https://www.mysql.com/products/enterprise/). 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 Enterprise Edition in a Master with multiple Replicas configuration across several nodes already procured by NCCT. The DMBSs 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

Task 4 – Bioinformatics Support

The contractor shall provide support in developing and managing bioinformatics and data analysis pipelines, including but not limited to database development and administration, statistical software programming (e.g., R), and bioinformatics techniques for analyzing diverse and, often, heterogeneous biological data. The contractor will support multiple research projects under EPA's Chemical Safety for Sustainability Research Program, including data management, integration, and analysis of ToxCast high-throughput screening data and the development and management of data and analysis pipelines from high-throughput transcriptomics and toxicogenomics experiments.

Subtask 4.1 – Toxicogenomics and High-Throughput Sequencing Bioinformatics Support

The contractor shall design and develop data management and analysis pipelines for large-scale concentration-response toxicogenomics data in collaboration with existing NCCT staff including, but not limited to, NCCT's Product Owners and Subject Matter Experts as well as existing on-site bioinformaticians. The contractor shall develop a database infrastructure for storing terabytes of sequencing and post-alignment data. The contractor shall develop or further develop custom data analysis pipelines for processing, analyzing and interpreting the complex and large concentration-response toxicogenomic data.

Contractor personnel must possess expertise in the following technologies:

1. MySQL and other potential database platforms
2. R (statistical programming language)
3. Perl
4. Python
5. Git Version Control System
6. Other open source tools and technologies as advised by NCCT staff

Subtask 4.2 – High-throughput Screening (e.g., ToxCast) Data Management & Analysis Support

The contractor shall manage, maintain and extend the ToxCast Data Analysis Pipeline (tcpl), as implemented in R and available on CRAN and GitHub. The contractor shall manage incoming ToxCast data streams and work with NCCT staff and other Subject Matter Experts to optimally analyze the data. The contractor shall also work with NCCT staff and Subject Matter Experts to appropriately annotate and maintain annotation of the hundreds of ToxCast assays. Therefore, the contractor shall have a working knowledge of high-throughput screening technologies to aid in the appropriate handling of the data, identification of potential data quality issues, and the appropriate descriptions of the assay systems.

Contractor personnel must possess expertise in the following technologies:

1. MySQL
2. R (statistical programming language)
3. Git Version Control System
4. Other open source tools and technologies as advised by NCCT staff

Task 5 – Intermediate Web Developer

The contractor shall provide web development 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. The participant will support the design, development, programming, testing and maintenance of multiple front end applications requiring access to chemical and biology data.

Subtask 5.1 – Development of Web Applications

The participant will assist in the design, coding and testing of technical user interface/UX development solutions 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. They will work closely with other members of NCCT team to create new and exciting web-based applications. The programs will be custom self-contained, database driven web applications, utilizing modularity and code re-use principals. They will participate in maintenance and upgrades to existing websites and applications. They will participate in team code reviews. The use of analytical and critical thinking skills will be needed for troubleshooting and applying solutions. They will need to gather and refine specifications and requirements based on technical needs. To improve productions, the participant will need to apply knowledge of industry trends and emerging technologies.

Subtask 5.2 – Development of Frontend Web Components

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 multiple Red Hat Enterprise Linux Servers. 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. Contractor should have a degree in computer science, information science or a related field of study, from an accredited university or college.
2. 3-5 years of Web Development experience
3. Exhibits provicincy in HTML, CSS, JavaScript, Ruby 4.x, Vue.js
4. Experience with jQuery and AJAX
5. Demonstrates basic knowledge of object and component design methodologies and technologies.
6. Familiarity with server-side MVC web frameworks
7. Possesses basic knowledge of classes, components, objects and interfaces
8. Awareness of cross-browser compatibility issues and client-side performance considerations
9. Understanding of full web-stack – from server to browser
10. Experienced with command line interface on Linux operating system

11. Familiar with Agile Scrum Methodology
12. Understands basic relational database concepts (MySQL and PostgreSQL) NoSQL is a plus.
13. Knowledge Git Version Control System
14. Other open source tools and technologies as advised by NCCT staff

Task 6 – Development Operations (DevOps) Engineer

The contractor shall develop environment and infrastructure that supports product teams for rapid deployment of NCCT's customer facing web applications and APIs. The contractor shall be responsible for maintaining an ecosystem that promotes the smooth flow of packaging and delivering software to a product environment for multiple teams and platforms with complex development branch interdependencies. The contractor services are primarily related to the EPA's Endocrine Disruptor Screening (EDSP) and the Toxcast Dashboard, however DevOps Engineer services may be required for support in projects. There are thousands of chemicals of interest to the EDSP and Toxcast Dashboard programs and data is collected and consolidated from disparate sources as collections of flexible widgets. EPA researchers developed the Endocrine Disruption Screening Program for the 21st Century Dashboard (EDSP21 Dashboard) to provide access to new chemical data on over 1,800 chemicals of interest. The Toxcast Dashboard can explore the biological activity for the chemical-assay combinations. The contractor shall maintain, operate, and secure data and software systems which provide for the management, preparation, publication, control and dissemination of information and technical data. 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 6.1 – DevOps Engineer – Implementation

DevOps is an emerging model of product delivery and full lifecycle management that emphasizes a holistic, end-to-end process. The contractor shall provide support in implementing DevOps environments and frameworks from beginning to end including completing the selection of tools, technologies and automation processes. The contractor shall perform various development activities for DevOps practices, including continuous integration, continuous delivery, continuous testing, and continuous monitoring. They will work collaboratively with software engineering teams to design continuous integration best practices, deploy applications and automate operations and processes.

Subtask 6.2 – DevOps Engineer – Support and Maintenance

The contractor shall maintain DevOps tools and systems that will include APIs, web portals, web applications, databases, and virtual servers that will help deliver high quality software quickly. The contractor shall apply knowledge of the latest best practices in the DevOps industry and engage with client facing teams to consult and implement DevOps practices. Currently, NCCT personnel manage Development, Internal Staging, Internal Production, External Staging and External Production environments. The contractor shall automate deployments and develop scripts to manage the configuration and integration of platforms. Scripts will need to be maintained due to changes in requirements or implementations and assist with setup and maintenance of test environments for manual and automated testing. The contractor shall write clear technical documentation, flow charts and diagrams for use by developers, system administrators, and testers.

Contractor personnel shall possess expertise in the following technologies and methodologies:

- Experience with Linux 6 & 7

- Experience with Linux shell scripting environments such as bash
- Experience with software source control tools such as Git.
- Experience with technologies including but not limited to Atlassian's suite (Confluence, Jira, Bitbucket)
- Experience with Jenkins, Maven, Vagrant, SonarQube, Logstash, Docker and Selenium is a plus.
- Experience working within infrastructure as a service is a plus
- Shall possess a thorough understanding of the Agile Scrum Software Development Lifecycle (SDLC)
- Shall possess a thorough understanding of configuration management, build management, release process and defect management.
- Other open source tools and technologies as advised by NCCT staff

Task 7 – System Administrator

The contractor shall provide support in serving as a technical expert and point of contact for the installation, configuration and testing of hardware and software associated with multiple operating systems and computer platforms to meet the specific EPA Program Office (PO) needs. The system administration support for existing environments and new environments is critical to maintain system stability, availability and continuity. The contractor services are related to the EPA's Endocrine Disruptor Screening (EDSP) Program to evaluate chemicals for potential endocrine disruption and the Toxcast Dashboard. There are thousands of chemicals of interest to the program and data is collected and consolidated from disparate sources as collections of flexible widgets. EPA researchers developed the Endocrine Disruption Screening Program for the 21st Century Dashboard (EDSP21 Dashboard) to provide access to new chemical data on over 1,800 chemicals of interest. The Toxcast Dashboard can explore the biological activity for the chemical-assay combinations. The contractor shall maintain, operate, and secure data and software systems which provide for the management, preparation, publication, control and dissemination of information and technical data required by this contract.

Subtask 7.1 – System Administration - Routine Duties

The contractor will provide technical assistance, analysis and troubleshooting to other IT personnel involved in system design, programming, database design, and integrating commercially available software. The systems will need to be maintained and optimized through daily, weekly and monthly patching, upgrades, and tuning when system maintenance is required. The contractor services are related to the EPA's Endocrine Disruptor Screening (EDSP) Program to evaluate chemicals for potential endocrine disruption and the Toxcast Dashboard.

The contractor shall analyze, evaluate, and recommend hardware/software changes to various computer systems and considers factors such as compatibility with standard systems, conversion or implementation costs, and impact on existing equipment.

The contractor shall assist other personnel with the implementation of the operating system releases and helps to maintain the operational status of systems. Determination and documentation of equipment requirements, communications, and interfaces with other systems will be required. The evaluation of

machine usage and Storage Area Network (SAN) based on current usage patterns and the development of plans for the acquisition of hardware and software will be needed to support future IT requirements.

Subtask 7.2 – System administration - Security and Documentation

The contractor shall work with additional personnel on the administration of all systems, including ensuring the efficient integration between systems as well as compatibility with Local Area Network (LAN).

The contractor shall develop guidelines, standard operating procedures (SOPs), knowledge base articles, test plans, and engineering diagrams concerning the operation/use of systems, services, and activities. The contractor will work with additional personnel to interpret higher authority regulations and guidance concerning IT system activities/services and coordinates with internal departments and external agencies concerning the resolution of problem areas encountered. The contractor will advise/communicate with the information management staff on issues pertaining to operating systems and hardware status. The contractor will assist other personnel with critical security management in accordance with EPA regulations and policies. The contractor will need to develop, document and analyzes local policies regarding system access, network rights, and physical access to systems and equipment.

Subtask 7.3 – System Administration - Disaster Recovery and Storage

The contractor shall plan and schedule the installation of new or modified hardware, operating systems, and server side software applications. The coordination of testing of server side vendor-provided software will be required. The contractor shall assist with the development, documentation, coordination, updates and validation of the procedures needed for system disaster recovery.

The contractor shall assist other personnel with the development of policy for all systems storage requirements throughout the center. They will assist with designing and modifying the storage structure and correlation between systems. The contractor will assist with modifying system parameters on multiple operating systems, integrating the use of Storage Area Networks (SAN), to achieve maximum system efficiency. The contractor will analyze and document system operating metrics to identify bottlenecks and take action to resolve problems and ensure optimal performance and consistency.

Contractor personnel must possess expertise in the following technologies:

1. RedHat Linux version 6 & 7
2. RedHat JBoss
3. Apache Tomcat software
4. Docker
5. Agile Scrum project methodologies a plus
6. Experience with technologies including but not limited to Atlassian's suite (Confluence, Jira, Bitbucket)
7. Experience with relational and non-relational databases databases including MongoDB, MySQL and PostgreSQL a plus
8. Ability to develop scripts to automate tasks (log rotation, temp space cleanup etc.)
9. 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 use the QAPP that was developed under work assignment 1-302 for this work assignment.

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.

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 Enterprise Edition 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
Task 4: Bioinformatics Support	Design and development of the data management and analysis pipelines for large-scale concentration-response toxicogenomics data; and provide management, maintainenance and extend the ToxCast Data Analysis Pipeline (tcpl).

Task 5: Develop dashboard web applications and frontend application code	Combine appropriate tools and data sources (via web sources) to deliver complete dashboard solutions. Provide quality support to the design, document, development, programming, testing and maintenance of multiple front end applications. Continuous completion of stories/bugs in multiple projects and deployed within NCCT multiple software application environments.
Task 6: Development Operations (DevOps) Engineer	Develop environment and infrastructure that supports product teams for rapid deployment of NCCT's customer facing web applications and APIs.
Task 7: System Administrator	Provide technical assistance, analysis and troubleshooting to other IT personnel involved in system design, programming, database design, and integrating commercially available software.

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 will meet daily with contractor(s) to review task progress, answer questions, provide clarification, and recommend changes or modifications to the initial project plan.

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 Enterprise Edition with ne Master and multiple Replicas
- Migrate existing SQL databases into the new MySQL Enterprise Edition
- 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

Task 4: As indicated in each Technical Directive issued. Deliverables for task 4 may include:

- Design and develop data management pipelines
- Develop database infrastructure for storing sequencing and post-alignment data
- Develop custom data analysis pipelines for processing, analyzing and interpreting concentration response toxicogenomic data
- Manage, maintain, and extend the ToxCast Data Pipeline
- Annotate and maintain annotation of hundreds of ToxCast assays

Task 5: As indicated in each Technical Directive issued. Deliverables for task 5 may include:

- Implement and document web-based Dashboard utilizing existing and new data
- Migrate existing dashboard applications into Vue.js
- Complete stories/bugs pertaining to web-based applications in multiple projects.
- Implement modular component strategies utilizing existing and new toolsets.
- Integrate existing data as well as new data within newly designed components
- Create unit, integration and acceptance tests for all modified code for quality assurance.
- Gather and document requirements based on technical needs.

Task 6: As indicated in each Technical Directive issued. Deliverables for task 6 may include:

- Build a DevOps environment and framework from scratch including a partial selection of tools, technologies and automation processes to complete the DevOps stack.
- Document the DevOps environment and framework created in bullet above.
- Create automated deployments and develop scripts to manage the integration of platforms.
- Regular maintenance to scripts will be needed due to changes in requirements or implementations.
- Document clear technical documentation, flow charts and diagrams of all best practices, setups and processes for use by developers, system administrators, and testers.

Task 7: As indicated in each Technical Directive issued. Deliverables for task 7 may include:

- Design, develop and document a plan/process for daily, weekly and monthly patching, upgrades, and tuning for system maintenance and security vulnerabilities
- Design and develop a plan/process for hardware refresh and future acquisitions
- Document and validate procedures for disaster recovery
- Document and evaluate parameters and metrics for the SAN
- Document and analyzes local policies regarding system access, network rights, and physical access to systems and equipment
- Document and provide a report on system operating metrics for consistency, reliability, and availability