EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-01

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	09/30/2015 To 09/29/2016 Base X Option Period Number	Spatial Spectral Commun Health

Contractor: PEGASUS TECHNICAL SERVICES, INC.

Specify Section and paragraph of Contract SOW: 4 E

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

Period of Performance: From 07/01/2016 To 09/29/2016

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

	Cost/Fee	LOE
Contract Period: 09/30/2015 To 09/29/2016		0
This Action:		0
Total:		0

Work Plan / Cost Estimate Approvals

	Cost/Fee	LOE
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name: Greg Toth	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-569-7242 FAX Number:
Project Officer Name: Michael Moeykens	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-569-7196 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

Contract EP-C-15-010
WA 0-01

TITLE: Development of Spatial, Spectral and Community Health Indicators of Exposure

WACOR:
Greg Toth
Exposure Methods & Measurement Division, MS 587
National Exposure Research Laboratory - Cincinnati
U.S. Environmental Protection Agency
26 W. Martin Luther King Drive Cincinnati, OH 45268
Phone: (513) 569-7242 Fax: (513) 569-7438

ALTERNATE WACOR:
Jim Owens
Exposure Methods & Measurement Division, MS 587
National Exposure Research Laboratory - Cincinnati
U.S. Environmental Protection Agency
26 W. Martin Luther King Drive Cincinnati, OH 45268
Phone: (513) 569-7235 Fax: (513) 569-7584

PERIOD OF PERFORMANCE:
Task 1 – CO Issuance – July 1, 2016
Tasks 2 -8 - July 1, 2016 through September 29, 2016.

LEVEL OF EFFORT: 3,090

GOAL/PURPOSE

This Work Assignment (WA) will provide the needed data analysis and technical support for both 1) integrating biological and/or ecological information with spatial data and 2) gathering, compiling, and analyzing information about various ecological and community health assessment tools.

BACKGROUND/OBJECTIVES

Ecological exposure research focuses on understanding how ecosystems come into contact with pollutants or stressors and how the behavior patterns of ecological receptors can either enhance or mitigate exposures. The National Exposure Research Laboratory's (NERL's) work includes providing tools for assessing and monitoring ecological exposure and conditions at the national, regional, and watershed scales. And NERL is in continual need of analytical support for the research activities that help to develop indicators and relate these endpoints to the characterization of stressors.

TASK 01: ORIENTATION

The work plan shall be configured to clearly align with the tasks outlined in this PWS as much as possible, including listing applicable SOPs by task. The Contractor shall meet with the WACOR for orientation, tour of the facilities, and SOP delivery. QA requirements for specific procedures are detailed in SOPs as needed.

Deliverable: Orientation within 15 days of the effective date of the approved work assignment and before the July 1 start date of the rest of the tasks.

TASK 02: ADVANCED GIS SUPPORT

As specified by written technical directives (no more than 7 anticipated) from the EPA Work Assignment Contracting Officer's Representative (WA-COR), the contractor shall provide advanced GIS support. GIS activities in support of SED projects may include, but are not limited to, creating maps with points of interest, such as sampling sites; delineating and analyzing watersheds; calculating land use indicators; developing spatial databases; determining the spatial co-location of data from sampling events, such as the collection of water chemistry, habitat, fish, and human population and use data; determining the spatial relationship between ecological endpoints and land use, as well as health and population data; developing scripts to run in GIS software; providing technical advice or recommending research direction to principal investigators (PIs) on how GIS may best suit their needs; developing novel approaches to spatial analyses; and other similar GIS related tasks. Written Technical Directives from the WA-COR may include services for various projects, such as Quantifying Spatial and Temporal Gradients of Wetland Connectivity, Improved Nutrient Indicator Development, and Great Lakes Communities Case Study, or projects that are similar in nature to those listed. The contractor shall utilize standard operating procedure SOP G-1-001, Quality Assurance in Geographic Information Systems, as guidance when completing GIS tasks. When necessary, the contractor shall review, modify, and create SOPs associated with the GIS laboratory, to maintain the integrity of GIS databases, files, and projects. The contractor shall also be prepared to provide technical advice for improving and/or updating the GIS laboratory. Finally, the contractor shall prepare and present a poster and/or platform presentation summarizing an innovative use of GIS in EPA research. This work shall be presented at a national scientific conference, the date/place to be specified by the WACOR by written technical direction. Electronic copies of all data, manuscripts, reports, and GIS products shall be provided by the contractor. Hard copies of maps shall be provided to the EPA WACOR, as necessary.

- SOP G-01-001 (Rev. 3), Quality Assurance in Geographic Information Systems – relevant to the work of the GIS Tasks (Tasks 02 and 04).

TASK 03: TECHNICAL WRITING AND LITERATURE SURVEY SUPPORT

The Contractor shall provide technical writing support for manuscripts, internal and external reports, Quality Assurance Project Plans (QAPPs), project proposals, training materials, and SOPs. The support shall include writing, editing, reviewing, formatting, creating graphics, ensuring compliance with Section 508 requirements, and conducting literature searches and literature reviews. The support shall also include the organization of data and some basic analyses, as necessary.

The Contractor shall provide literature survey, technical writing, database, and data management support to the Health Impact Assessment (HIA) Development and Health Tool Development. This may include activities such as, but not necessarily limited to, searching for

and reviewing literature, organizing report reviews, preparing reports, developing training materials, developing databases, and presenting results. If the work shall be presented at a national scientific conference, the date/place will be specified by the WACOR by written technical direction

All work under this Task shall proceed following receipt of written Technical Direction from the EPA WACOR (no more than 3). The Contractor shall follow all existing Task-relevant SOPs (e.g., file management SOPs) and update or create SOPs, as necessary, to maintain the integrity of the relevant databases, files, and projects.

- SOP G-03-001 (Rev. 3), Quality Assurance in Technical Writing and Editing – relevant to the work of the Technical Writing (Task 03), Public Health (Tasks 06 and 08) and Literature Review (Tasks 09 and 10) Tasks

TASK 04: GREEN-INFRASTRUCTURE-RELATED GIS SUPPORT

This Task shall be particularly focused on the Green Infrastructure Project. The Contractor shall provide GIS support such as, but not necessarily limited to, creating maps, making delineations, organizing and populating Arc View databases, compiling data to aid in identifying land owners, developing presentation materials, and other basic GIS-related tasks.

All work under this Task shall proceed upon receipt of written Technical Direction from the EPA WACOR (no more than 2). The Contractor shall follow all Task-relevant GIS SOPs.

- SOP G-01-001 (Rev. 3), Quality Assurance in Geographic Information Systems – relevant to the work of the GIS Tasks (Tasks 02 and 04).

TASK 05: REMOTE SENSING ANALYSES

As initiated upon receipt of written technical directives from the WA-COR (no more than 3), the contractor shall provide remote sensing services to projects such as Quantifying Spatial and Temporal Gradients of Wetland Connectivity, Improved Nutrient Indicator Development, or projects that are similar in nature to those listed. The contractor shall use ground truth data along with acquired remote sensing images, to classify inundation patterning, climatic characteristics, and vegetation/habitat classes in selected study areas. The contractor may be responsible for preparing a draft manuscript detailing the methods and results for these projects and aid in the revision of these and any related manuscripts (as necessary) to make them suitable for publication in a peer-reviewed journal. The contractor may need to classify remotely sensed images. The contractor shall utilize standard operating procedure SOP G-2-001, Quality Assurance in Remote Sensing as guidance when completing remote sensing tasks. Finally, the contractor shall prepare and present a poster or platform presentation summarizing an innovative use of remote sensing in EPA research. This work shall be presented at a national scientific conference, the date/place to be specified by the WACOR by technical direction. The contractor shall produce a report summarizing the work initiated by technical directives under this task. Electronic copies of all manuscripts, reports, SOPs, summaries of literature searches, literature reviews, and other remote sensing products shall be provided by the contractor. Hard copies shall be provided as necessary.

- SOP G-02-001 (Rev. 3), Quality Assurance in Remote Sensing – relevant to the work of the Remote Sensing Task (Task 05)

TASK 06: Health Impact Assessment (HIA) DEVELOPMENT

Initiated by technical direction (not more than 3) from the WACOR, the Contractor shall assist in the development of the HIAs for the Proctor Creek Watershed, Great Lakes Area of Concern Community, and Suffolk County Projects. The HIAs will examine the health, environmental, and economic impacts of the policies or plans in their respective communities. The development of the HIAs will produce tools and approaches for conducting HIAs that other communities can use for sustainable solutions and to generalize lessons learned.

The Contractor shall assist with development of materials and training for Regional EPA National Environmental Policy Act (NEPA) reviewers to support consideration of the use of HIA and elements of HIA in the NEPA Environmental Impact Statement (EIS) process. This will also encompass the consideration of how HIA will help meet requirements for environmental justice analysis in NEPA and other Agency actions.

The Contractor's support shall include writing, editing, reviewing, creating and editing graphics, conducting literature searches and literature reviews, collecting data, organizing databases, data analysis, communication with stakeholders, preparing and presenting reports and training materials. The contractor shall utilize SOP G-3-001, Quality Assurance in Technical Writing and Editing, as guidance when completing technical writing tasks. Deliverables under this task shall consist of summaries of literature searches and literature reviews, documentation for each step of the HIA process, communication materials including executive summaries, fact sheets and posters (if needed) and a final HIA report.

The Contractor shall produce a report summarizing the work initiated by technical directives under this Task. The Contractor shall provide electronic copies of all deliverables. The Contractor shall provide hard copies as necessary.

TASK 07: COMMUNITY HEALTH TOOL DEVELOPMENT

Initiated by technical direction (no more than 3) from the WACOR, the contractor shall provide support in the development of guidance and recommendations for improving upon the HIA process as it is applied by the community of practice. The Contractor's support shall include writing, editing and reviewing HIA-related documents; creating and editing graphics; conducting literature searches and literature reviews; collecting data; organizing databases; and data analysis. This task will also include development and presentation of HIA training materials for EPA Regional Offices and other entities as requested. The contractor shall utilize SOP G-3-001, Quality Assurance in Technical Writing and Editing, as guidance when completing technical writing tasks. Deliverables for these projects will include summaries of literature searches and reviews, HIA training materials consisting of power point presentations, worksheets and supporting documentation, summaries of databases and data analysis, and reports. The Contractor shall produce a report summarizing the work initiated by technical directives under this Task. Electronic copies of all deliverables will be provided by the contractor. Hard copies shall be provided if necessary.

DELIVERABLES TASKS 2 – 7	**DUE DATES**
As specified in the task content	**1 -2 months following TD Some intermediate deliverables with quick turnaround, 2 days to 2**

weeks

TASK 08: GREAT LAKES "AREAS OF CONCERN": REMEDIAL ACTION PLAN REVIEW AND SEARCH

The contractor shall search existing Remedial Action Plan documents related to Great Lakes "Areas of Concern" and report out a specific set of information elements.

Background:

The evaluation of ecosystem services is a relatively new aspect of environmental decision-making; methods and advantages of doing so are not yet well established. An effort is being made to develop a conceptual framework that integrates changes in ecosystem services resulting from decisions made by EPA's Great Lakes National Program Office, Great Lakes communities, and others, to remove "beneficial use impairments" (BUIs). The effort is focusing on Great Lakes "Areas of Concern" (AOCs), which are specially designated locations that have experienced environmental degradation.

Deliverable:

For all or most of 31 US AOCs, the contractor shall examine Remedial Action Plan (RAP) documents and associated materials, and draw from them information to populate a framework that qualitatively illustrates plausible causal linkages between remediation decisions, restoration decisions and changes in ecosystem state, BUIs, ecosystem goods and services, and human well-being.

Information to be gleaned from RAP documents include the following:

- Biophysical characteristics of the Area of Concern
- Water uses (public water supply, recreation, and commercial)
- Chemicals of concern (COC)
- Beneficial Use Impairments (BUIs)
- Human health concerns
- Sources of BUIs
- BUI measures/indicators and thresholds
- Remediation and restoration actions
- Cost of remedial actions/tasks
- Delisting/restoration of BUIs
- Potential final ecosystem goods and services (goods/service + beneficiary)
    - Extent change (possibly in terms of providing area)
    - Access
    - Expected recovery time

These elements will be included in tabular listings of framework elements for each AOC, highlighting plausible expectations of change due to past or potential remedial actions.

Delivery:

The task shall be completed in a phased approach: initially, for the first three AOCs (Maumee River, OH; Ashtabula River, OH; St. Louis River, MN), then the remaining AOCs. Each phase

will consist of:

- Development of a list of RAP documents and associated material
- Evaluation of the materials and population of the draft framework

A principal investigator, together with the WACOR, will be reviewing each stage of each phase. The deliverable shall be the draft framework as of September 29, 2016.

TASK 8 DELIVERABLES	**DUE DATE**
Task 05 Summary of Remote Sensing Work	September 29, 2016
Report on Task 06 HIA Work	September 29, 2016
Report on Task 08 HIA Work	September 29, 2016
Report on Task 10 Great Lakes Remedial Action Plan Search	September 29, 2016
Report for HIA in Suffolk County	September 29, 2016

REPORTING REQUIREMENTS: As part of the monthly progress report required by the contract, one copy of a brief written work assignment status report shall be furnished to the COR by the 15th of the month. This report shall include:

- all Tasks in the PWS,
- a ***brief*** (i.e., no more than 1 page per Task) description of work performed for each PWS Task,
- any problems encountered in completing Tasks
- any steps taken to solve those problems,
- work planned for the next reporting period,
- staffing,
- budget, and
- approximate hours spent (by P level) on each PWS task.

Presentation-style reports shall be provided in Microsoft Powerpoint. Poster-style reports shall be provided both in hard copy and in electronic copy in either Powerpoint or Adobe Illustrator.

MEETINGS: Meetings shall be held between the Contractor and WACOR with additional EPA staff as determined by the WACOR to discuss task details or results achieved by the Contractor.

STAFFING REQUIREMENTS: This work assignment requires personnel with expertise in 1) ecological applications of GIS using the ESRI suite of software tools, 2) ecological and hydrological applications of Remote Sensing using ERDAS software, 3) technical writing with particular emphasis on Ecology using Microsoft, Corel and Adobe software packages 4) ecological applications of standard statistical packages such as SAS, R, SYSTAT, and SigmaStat, as well as multivariate statistical programs, such as PC-ORD and 5) basic Arc GIS knowledge.

QUALITY ASSURANCE REQUIREMENTS: All GIS and Remote Sensing work must follow the developed SOPs; database management must be completed using the developed SOPs, provided by the WACOR. If a procedure called for does not have an SOP already developed, the Contractor shall develop or obtain an SOP for that method and submit it to the WACOR for approval before work proceeds. When applicable, the Contractor shall work

according to the QAPP for specific projects.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-01

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	09/30/2015 To 09/29/2016 Base X Option Period Number	Spat., Spect.,Comm. Indicators

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	4 E

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

Period of Performance: From 07/01/2016 To 09/29/2016

Comments:
The purpose of this amendment is to all language to Task 5.

☐ 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

	Cost/Fee:	LOE:
Contract Period: 09/30/2015 To 09/29/2016		0
This Action:		0
Total:		0

Work Plan / Cost Estimate Approvals

	Cost/Fee	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name Greg Toth	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-569-7242 FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-569-7196 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:

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-2

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	To	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X	Option Period Number	Next generation sequencing

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	4 D

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

Period of Performance: From 10/01/2015 To 09/30/2016

Comments:
The contractor shall immediately start work on all tasks listed in the Work Assignment Performance Work Statement.

☐ 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 (Max 7)
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Authorized Work Assignment Ceiling

Contract Period: To — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name Mark Rodgers	(Signature)	(Date)	Branch/Mail Code:
			Phone Number 513-569-7225
			FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7196
			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
Contract EP-C-15-010
Work Assignment 0-02

Work Assignment Contracting Officer's Representative: Mark Rodgers ph. 513/569-7225

Alternate WACOR: Karen Schrantz ph. 513-569-7288

Period of Performance: CO Issuance through September 29, 2016

Work Assignment title: The use of next generation sequencing and metagenomic analyses in understanding the microbial ecology of biofilm communities.

Background:
The Water Supply and Water Resources Division (WSWRD) which is part of the EPA Office of Research and Development's National Risk Management Research Laboratory (NRMRL), conducts research into ways to prevent and reduce risks from pollution that threaten human health and the environment. Specifically, the Division investigates methods and their cost-effectiveness for prevention and control of pollution to water and subsurface resources; protection of water quality in public water systems; remediation of contaminated surface and ground water; and restoration of ecosystems. A number of WSWRD research projects are focused on studying microbial communities in an attempt to better understand the environmental conditions necessary for the growth and survival of indigenous waterborne human pathogens. These studies require expertise in high-throughput sequencing and the use of software to analyze large genomic datasets.

Description of Services:
The work assignment involves the use of next generation sequencing technology and the appropriate computer software programs to characterize the microbial communities of water and biofilm samples from large building premise plumbing systems, both in terms of taxonomy (i.e. using 16S or other) and functionality (i.e. metagenomics and metatranscriptomics) with additional analysis of the genome of waterborne isolates (whole genome sequencing).

It is expected that the contractor will be provided 20 to 30 samples per month, with no more than 360 samples per the work assignment period of performance.

The samples will include such samples as biofilm material from faucet/showerhead/pipe swabbing, annular reactor coupons and bulk water from both pilot-scale experiments and field sampling.

The contractor will collect and process samples, to include the extraction of nucleic acid from the samples and use the extracts in PCR assays for the detection of bacterial populations using different phylogenetic and function specific genes.

The nucleic acid samples will also be submitted for next generation sequencing. Sequencing services will include 16S metagenomics (no more than 200 samples), genome sequencing (no

more than 40 samples with 0.4GB output), metagenome sequencing (no more than 24 samples with 2-3GB output) and metatranscriptomics sequencing (no more than 12 samples with a 2-3 GB output). The contractor shall receive the raw sequencing data from the MiSeq instrument (Illumina technology), download from an FTP site, format it appropriately and process the data to assess sequence read quality, building contigs, identifying contigs, and any other necessary analyses. The contractor shall have experience with software and data analysis tools used to analyze large genomic data sets including MOTHUR, BioEdit, SILVA, SPADE, FastQC, BBMap, QUAST, Mauve, RDP Classifier, BLAST and MEGAN. Based on data analyses, the contractor shall generate figures and tables for peer reviewed publications.

The contractor shall aid in preparing presentations to be given at national scientific conferences. The contractor shall attend the 7th Annual Argonne Soil Metagenomics Meeting, October 21-23, 2015, in Lisle, IL, for the purpose of bringing back to the project the latest developments in the use of bioinformatics analysis in the study of microbial communities. The contractor shall attend and make a presentation at the Water Quality Technology Conference, November 15-19, 2015, in Salt Lake City UT.

The contractor shall be responsible for proper archiving of all sequencing data and the information generated from the analysis of this data according to EPA Information Management policies.

Other Work Assignment Requirements:
The contractor is expected to have demonstrated experience in the use of molecular techniques such as DNA and RNA extractions from environmental samples, use of polymerase chain reaction (PCR) assays, cloning of PCR amplicons, qPCR and hybridization assays. In addition, statistical comparisons of genomic data collected and analyzed across samples in a study will need to be performed. In some cases, genomic data will be assessed for correlations or patterns with other types of data collected within a study. Additionally, other analyses may be needed. The contractor shall have knowledge of general microbiological techniques such as aseptically handling of bacterial pure cultures, and water filtration.
The contractor shall have experience in design, set-up, and operation of laboratory and larger scale experiments used to answer drinking water research questions. This may include but not be limited to the use of annular reactors and CDC reactors to grow biofilm on various materials under different disinfection regimes for subsequent analysis.

Description of Working Conditions:
Services under this Work Assignment shall be performed in the Microbial Contaminants Control Branch (MCCB) microbiology laboratories located within the AWBERC building. The contractor will be exposed to laboratory chemicals and process environmental samples from different matrices (including those mentioned above) in a laboratory setting. In some cases, long periods of standing might be required. The contractor will be required to wear safety apparel and to follow established laboratory procedures.

The contractor shall perform work under the existing Quality Assurance Project Plan W-20090 (Water Quality Monitoring in Hospitals Before/After Copper-Silver Ionization) (to be provided separately by the WAM). The contractor shall also assist in revising the Health and Safety Plan

(HASP# 2014-025), and with any needed modifications to either the Quality Assurance Project Plan or the Health and Safety Plan.

Outputs/Deliverables:

The contractor shall record all work in a black bound laboratory notebook which shall be provided by the EPA WACOR for this work assignment. The contractor shall maintain careful and accurate records in this Laboratory Notebook. In addition the contractor shall maintain working and back-up electronic files on external hard drives and on the Agency network storage drive(s). The contractor and the Work Assignment Contractor Officer's Representative shall have weekly meetings in person or via conference call to discuss results and experimental design, during the entire work assignment period of performance.

There shall attend monthly meetings with the WACOR to discuss the data that has been generated. These discussions shall cover the data analysis and any laboratory procedural issues.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-03

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	To	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X	Option Period Number	Develop of W/WW treatment tech

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	4.C

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

Period of Performance: From 09/30/2015 To 09/29/2016

Comments:
The contractor shall immediately start work on all tasks listed in the Work Assignment Performance Work Statement.

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

SFO (Max 2) ☐

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

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1										
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Authorized Work Assignment Ceiling

Contract Period: To — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name Mark Rodgers	(Signature)	(Date)	Branch/Mail Code: Phone Number 513-569-7225 FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-569-7196 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
Contract **EP-C-15-010**
Work Assignment 0-03

Work Assignment Contracting Officer's Representative:
Mark Rodgers ph. 513/569-7225

Alternate WACOR: Jonathan Pressman ph. 513-569-7625

Period of Performance: September 30, 2015 through September 29, 2016

Project title: Development of water/wastewater treatment technologies

Background:
The Water Supply and Water Resources Division (WSWRD) which is part of the EPA Office of Research and Development's National Risk Management Research Laboratory (NRMRL), conducts research into ways to prevent and reduce risks from pollution that threaten human health and the environment. Specifically, the Division investigates methods and their cost-effectiveness for prevention and control of pollution to water and subsurface resources; protection of water quality in public water systems; remediation of contaminated surface and ground water; and restoration of ecosystems. One specific WSWRD research area is the development and evaluation of treatment technologies that can be applied to produce potable water and to treat wastewaters such that they can be either discharged safely into receiving waters or reclaimed for other purposes (e.g. direct potable reuse). Interest in increasing the sustainability of the total water system from supply through wastewater treatment is leading to the desire to reduce energy requirements and resources that can be recovered. The EPA is interested in exploring the performance of ultraviolet light produced by light emitting diodes as a means to inactivate viral pathogens. The EPA is interested in drinking water treatment technologies and their impact on the viability of indigenous pathogens such as *Legionella.*

Description of Services:
The work under this Work Assignment will be divided into three separate subtasks:
Subtask 1:
The contractor shall develop and evaluate treatment technologies designed to produce reclaimed water from wastewaters. The contractor shall participate in the design of membrane bioreactors that solve existing challenges to the use of this technology, including membrane fouling, limitations imposed by lower hydraulic retention times and temperature, methane recovery and nutrient removal. Effluents from bioreactors shall be evaluated for possible continued treatment for various fit-for-purpose scenarios. Research shall be conducted using bench- and pilot-scale reactors and systems.

This work will require an approved Health and Safety Plan and a Quality Assurance Project Plan. Existing HASPs and/or QAPPs and SOPs that are relevant to this work may be utilized and will be provided by the WACOR to the contractor. HASPs, QAPPs and SOPs will be amended as needed during the life of this WA.

The contractor is expected to have demonstrated experience in the design and use of bioreactors and microbial ecology of wastewater treatment.

Subtask 2:
The contractor shall evaluate ultra violet (UV) light emitting diode (LED) technology applied to the disinfection of waters designed for potable use. A collimated beam apparatus with a series of LED lamps producing light energy at specific wavelengths is available and shall be used in this task. Dose-response curves will be generated for the inactivation of a range of viral species, including adenovirus, Coxsackie virus, rotavirus and other enteric viral and bacterial pathogens.

This work will require an approved Health and Safety Plan and a Quality Assurance Project Plan. Existing HASPs and/or QAPPs and SOPs that are relevant to this work may be utilized and will be provided by the WACOR to the contractor. HASPs, QAPPs and SOPs will be amended as needed during the life of this WA.

The contractor is expected to have demonstrated experience with collimated beam apparatus use and calibration, UV inactivation of microorganisms and microbiological techniques for determining viability and infectivity of bacterial and viral pathogens (including tissue culture and integrated cell culture-qPCR techniques).

Subtask 3. The contractor shall develop an assay appropriate for determining viability of *Legionella* bacteria after disinfection with both chemical and UV treatments. Resuscitation in free-living amoeba, detection of mRNA transcription and nucleic acid-binding dyes shall be considered and evaluated.
Contractor shall prepare a presentation and present results at the American Society for Microbiology Annual Meeting in Boston, MA, 2016. The WACOR will submit a written technical directive to provide details on this meeting. The contractor shall request travel in accordance with the contract clause.

This work will require an approved Health and Safety Plan and a Quality Assurance Project Plan. Existing HASPs and/or QAPPs and SOPs that are relevant to this work may be utilized and will be provided by the WAM to the contractor. HASPs, QAPPs and SOPs will be amended as needed during the life of this WA.

The contractor is expected to have demonstrated experience with culturing bacteria and molecular biology technologies.

Description of Working Conditions:
Work shall be performed in the MCCB microbiology laboratories located within the AWBERC building. The contractor will be exposed to laboratory chemicals and process environmental samples from different matrices (including those mentioned above) in a laboratory setting. In some cases, long periods of standing might be required. The contractor will be required to wear safety apparel and to follow established laboratory procedures.

Outputs/Deliverables:

The contractor shall record all of his/her work in black bound laboratory notebooks which shall be provided by the WACOR for this work assignment. These notebooks, and all other data produced under this work assignment will be the property of the Environmental Protection Agency. Raw data may also be recorded electronically in the form of spreadsheets for analysis.

The contractor and the WACOR shall have weekly meetings in person or via conference call to discuss results and experimental design, during the entire work assignment period of performance. These meetings will include discussion of the data recorded in the notebook from the previous week, data analysis and any laboratory procedural issues.

The contractor shall assist the WACOR in drafting one or two manuscripts describing the results of the research, as the data allows. The contractor shall assist in the preparation of one or two additional presentations, in addition to that described in Task 3, however, no additional travel will be required or provided.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-04

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X To Option Period Number	OFFICE OF RESEARCH AND DEVELOP

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	4E and 4F

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

Period of Performance: From 10/23/2015 To 09/29/2016

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 (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: To — 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 Diane Yates	(Signature)	(Date)	Branch/Mail Code: Phone Number 850-934-9325 FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-569-7196 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
Contract EP-C-15-010
Work Assignment: 0-04
TITLE: DNA 16S and 18S rRNA Gene Sequencing Services

Work Assignment Contracting Officer's Representative WACOR:

Diane Yates

Alternate WACOR:

Dr. Jim Hagy

Period of Performance: CO Issuance to September 29, 2016

BACKGROUND

The Office of Research and Development (ORD) will use the application of next-generation sequencing (NGS) to provide insight into microbial communities relevant to water quality assessments in freshwater streams. The objective of this research is to evaluate the effect of best management practices (BMP) on water quality in coastal streams as part of the Gulf of Mexico Initiative (GOMI). The long-term goal is to improve the scientific basis for evaluating management approaches by identifying and quantifying environmental factors and processes for sustainable aquatic ecosystems. Molecular approaches, sequencing of phylogenetic genes for bacterial communities (16S rRNA), and algal communities (18S rRNA) will provide taxonomic overview of the bacteria and algae in response to natural, livestock/agriculture runoff and BMP-mitigated streams.

The GOMI was designed to help producers/farmers in Alabama, Florida, Mississippi, Louisiana and Texas improve water quality. The GOMI seeks to apply sustainable agricultural management systems that, in addition to reducing nutrient and sediment runoff, also maintains crop and livestock productivity. The combination of traditional stream water-quality and biotic responses to the implementation of BMP will be studied in GOMI priority watersheds. Priority watersheds will be determined by the GOMI and other stakeholders such as USDA, the Porch Creek Indian tribe and the Alabama and Mississippi Department of Environmental Management personnel. Watersheds of interest will be located in northwest Florida, Mississippi and Alabama. This project is authorized under the Clean Water Act, Safe and Sustainable Water Resources (SSWR) 4.02A (Nutrient Indicators).

PURPOSE

The purpose of this work assignment is for the contractor to perform next-generation sequencing (NGS) from the DNA provided by EPA. NGS will be sequencing the bacterial 16S rRNA and algal 18S rRNA genes. Samples will be labeled accordingly by the EPA.

EPA will perform the DNA extractions using established protocols and will ship the frozen DNA overnight in a Styrofoam container to maintain DNA integrity. All tubes containing DNA will be DNase free and stored frozen at minus 20 ° C until processed by the contractor.
The EPA at Gulf Breeze, FL (GED) will provide approximately 525 DNA samples for 16S sequencing and 525 samples for 18S sequencing during the WA PoP, with an approximate quarterly shipment of 200 samples; an approximate 1050 total number of samples equating to 5 or 6 sequencing runs. The samples will be shipped directly to the contractor. Each tube containing DNA will be labeled according to a sample designation as assigned by EPA and used in the sequencing reactions performed by the contractor. The contractor will be contacted by the WACOR regarding the number of samples to be sequenced for each shipment. Once the samples arrive, the contractor shall notify the WACOR (Diane Yates) and the originator (Dr. Stephanie Friedman) that the samples were received.

Sequencing results shall be provided to the EPA WACOR and to the originator, Dr. Stephanie Friedman, via an electronic file in a FASTQ format. EPA will provide approximately 1050 DNA samples. If a sample cannot be sequenced due to QA/QC or other problems, the problem will be resolved and the sample re-sequenced. The contractor shall contact the WACOR if additional DNA is needed in order to repeat the sequencing.

EPA will provide the following:

1. Purified DNA for each sample to be sequenced.
2. DNA will be provided in the concentration as recommended by the contractor.
3. A spreadsheet will be provided with each shipment listing each sample ID and desired sequencing run (16S rRNA gene and/or 18S rRNA gene).

Contractor shall provide the following:

1. Tubes, chips and molecular barcodes, if necessary, to be used in sequencing. All tubes, pipette tips, etc, must be DNase-free.
2. DNA clean-up kits, sequencing kits, primers, laboratory equipment (i.e., gel electrophoresis, centrifuges, thermal cyclers, etc.,) and any related reagents needed to complete the tasks herein.
3. Electronic gel images that are annotated with the sample identification (ID).
4. All electronic or hardcopy files (FASTQ and/or other data quality files).

DESCRIPTION OF TASKS

Task 1. DNA manipulation:

The contractor shall, according to the contractor's standard protocols for their sequencing platform, perform any further DNA purification, clean-up or concentration as needed to ensure quality sequencing runs. In addition, the contractor shall prepare all of the DNA libraries as required to complete the work assignment.

Task 2. DNA sequencing:
The EPA WACOR will provide the DNA samples for sequencing. Each sequencing reaction will utilize paired-end sequencing with complete overlap of forward and reverse reads. Each sequenced sample will yield approximately 5Mb of data, with 20-40X coverage using the contractor's sequencing platform. Sequencing the 16S rRNA gene will cover the full-length of the amplicon. Sequencing the 18S rRNA gene for diatoms will cover the full-length of the amplicon or approximately 200 bp using paired-end sequencing.

Primer pairs for 16S rRNA gene will be the V4 region including the forward primer F515 and reverse primer R806.

Primer pairs for the 18S rRNA gene for diatoms are as follows:

Bacillariophyceae 1209F forward 5' CAG GTC TGT GAT GCC CTT 3'

Diatom 18S R1 reverse 5' CAA TGC AGW TTG ATG AWC TG 3'

Yields an approximate 200 bp amplicon.

Primers are published in the following: Godhe et al., 2008. Quantification of diatom and dinoflagellate biomasses in coastal marine seawater samples by real-time PCR. Appl Environ Microbiol, 74(23):7147

QA/QC:
The contractor shall comply with QA/QC as required by the NGS platform established by the manufacturer. A copy of the manufacturer's or the contractor's QA/QC specific to the contractor's sequencing platform shall be provided to the EPA WAM. The high-quality reads (Phred 20) shall be a minimum of 85% based on the total number of reads. If the quality is less than 85% and the Phred score is less than 20 the run shall be repeated. Contractor laboratory personnel shall be trained in molecular biology techniques including sample handling, DNA purification and concentration, gel electrophoresis, polymerase chain reaction (PCR), primer preparation, DNA quantification and NGS procedures.

DELIVERABLES
All raw data files that are generated by NGS runs will be sent to the WACOR, including FASTQ files, quality score files and any contig files if produced. Files can be submitted electronically or via airmail on an external drive with back-up files being maintained by the contractor during this work assignment.

ACCEPTANCE PROCEDURE FOR DELIVERABLES

1. Deliverables shall be submitted to the WACOR at the following location:

Attn: Diane Yates
US EPA
1 Sabine Island Drive
Gulf Breeze, FL
32561

Email: yates.diane@epa.gov
Phone: 850-934-9325

Copied to Dr. Stephanie Friedman
Email: friedman.stephanie@epa.gov

2. If any problems arise, the WACOR will advise the contractor within four weeks of receipt of any data. The contractor has six weeks in which to revise or re-run any sequences beginning on the date of contact with the WACOR regarding such data.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-04

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	To	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X	Option Period Number	DNA 16s and 18s gene sequencin

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	Task 1 and Task 2

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

Period of Performance: From 10/23/2015 To 09/29/2016

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 (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: To — 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 Diane Yates	(Signature)	(Date)	Branch/Mail Code:
			Phone Number 850-934-9325
			FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7196
			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
Contract EP-C-15-010
Work Assignment: 0-04
Amendment 1
TITLE: DNA 16S and 18S rRNA Gene Sequencing Services

Work Assignment Contracting Officer's Representative WACOR:

Diane Yates

Alternate WACOR:

Dr. Jim Hagy

Period of Performance: CO Issuance to September 29, 2016

The purpose of this amendment is to make changes to tasks 1 and 2. All changes to the PWS are highlighted below.

BACKGROUND

The Office of Research and Development (ORD) will use the application of next-generation sequencing (NGS) to provide insight into microbial communities relevant to water quality assessments in freshwater streams. The objective of this research is to evaluate the effect of best management practices (BMP) on water quality in coastal streams as part of the Gulf of Mexico Initiative (GOMI). The long-term goal is to improve the scientific basis for evaluating management approaches by identifying and quantifying environmental factors and processes for sustainable aquatic ecosystems. Molecular approaches, sequencing of phylogenetic genes for bacterial communities (16S rRNA), and algal communities (18S rRNA) will provide taxonomic overview of the bacteria and algae in response to natural, livestock/agriculture runoff and BMP-mitigated streams.

The GOMI was designed to help producers/farmers in Alabama, Florida, Mississippi, Louisiana and Texas improve water quality. The GOMI seeks to apply sustainable agricultural management systems that, in addition to reducing nutrient and sediment runoff, also maintains crop and livestock productivity. The combination of traditional stream water-quality and biotic responses to the implementation of BMP will be studied in GOMI priority watersheds. Priority watersheds will be determined by the GOMI and other stakeholders such as USDA, the Porch Creek Indian tribe and the Alabama and Mississippi Department of Environmental Management personnel. Watersheds of interest will be located in northwest Florida, Mississippi and Alabama. This project is authorized under the Clean Water Act, Safe and Sustainable Water Resources (SSWR) 4.02A (Nutrient Indicators).

PURPOSE

The purpose of this work assignment is for the contractor to perform next-generation sequencing (NGS) from the DNA provided by EPA. NGS will be sequencing the

bacterial 16S rRNA and algal 18S rRNA genes. Samples will be labeled accordingly by the EPA.

EPA will perform the DNA extractions using established protocols and will ship the frozen DNA overnight in a Styrofoam container to maintain DNA integrity. All tubes containing DNA will be DNase free and stored frozen at minus 20 ° C until processed by the contractor.
The EPA at Gulf Breeze, FL (GED) will provide approximately 525 DNA samples for 16S sequencing and 525 samples for 18S sequencing during the WA PoP, with an approximate quarterly shipment of 200 samples; an approximate 1050 total number of samples equating to 5 or 6 sequencing runs. The samples will be shipped directly to the contractor. Each tube containing DNA will be labeled according to a sample designation as assigned by EPA and used in the sequencing reactions performed by the contractor. The contractor will be contacted by the WACOR regarding the number of samples to be sequenced for each shipment. Once the samples arrive, the contractor shall notify the WACOR (Diane Yates) and the originator (Dr. Stephanie Friedman) that the samples were received.

Sequencing results shall be provided to the EPA WACOR and to the originator, Dr. Stephanie Friedman, via an electronic file in a FASTQ format. EPA will provide approximately 1050 DNA samples. If a sample cannot be sequenced due to QA/QC or other problems, the problem will be resolved and the sample re-sequenced. The contractor shall contact the WACOR if additional DNA is needed in order to repeat the sequencing.

EPA will provide the following:

1. Purified DNA for each sample to be sequenced.
2. DNA will be provided in the concentration as recommended by the contractor.
3. A spreadsheet will be provided with each shipment listing each sample ID and desired sequencing run (16S rRNA gene and/or 18S rRNA gene).
4. Reference DNA for optimizing 18S rRNA gene PCR.

Contractor shall provide the following:

1. Tubes, chips and molecular barcodes, if necessary, to be used in sequencing. All tubes, pipette tips, etc, must be DNase-free.
2. DNA clean-up kits, sequencing kits, primers, laboratory equipment (i.e., gel electrophoresis, centrifuges, thermal cyclers, etc.,) and any related reagents needed to complete the tasks herein.
3. Electronic gel images that are annotated with the sample identification (ID).
4. All electronic or hardcopy files (FASTQ and/or other data quality files).

DESCRIPTION OF TASKS

Task 1. DNA manipulation:
The EPA WAM will provide the DNA samples to be PCR'd in preparation for sequencing. The contractor shall perform PCR according to the contractor's standard

protocols to include any linkers and bar codes required for their sequencing platform. In addition, the contractor shall prepare all of the DNA libraries as required to complete the work assignment.

PCRs for 16S and 18S rRNA genes shall use 1 µl of supplied DNA per 25 µl of PCR reaction. Should PCR amplification of the expected sized DNA fragment fail with 1 µl of supplied DNA per 25 µl of PCR reaction, the contractor shall repeat the PCR using 1 µl of a 1:10 dilution prepared from the supplied DNA per 25 µl of PCR reaction. Should PCR amplification of the expected sized DNA fragment fail with 1:10 µl of supplied DNA per 25 µl of PCR reaction, the contractor shall repeat the PCR using 1 µl of a 1:100 dilution prepared from the supplied DNA per 25 µl of PCR reaction. The contractor shall notify the WAM should PCR with the 1:100 dilution fail.

The primer pair for 16S rRNA gene V4 region amplification is forward primer F515 and reverse primer R806.

Primer sequences for the 18S rRNA gene for diatoms are as follows:

Bacillariophyceae 1209F forward 5' CAG GTC TGT GAT GCC CTT 3'

Diatom 18S R1 reverse 5' CAA TGC AGW TTG ATG AWC TG 3'

Yields an approximate 200 bp amplicon.

This primer pair is selective for diatom 18S rRNA gene sequences. These diatom selective primers are described in Godhe et al., 2008. Quantification of diatom and dinoflagellate biomasses in coastal marine seawater samples by real-time PCR. Appl Environ Microbiol, 74(23):7147.

The contractor shall optimize PCR conditions (PCR primer annealing temperature, Mg concentration) for the 1209F and 18S R1 primer pair using diatom reference DNA supplied by the WAM.

Task 2. DNA sequencing:
The contractor shall, according to the contractor's standard protocols for their sequencing platform, perform any further DNA purification, clean-up or concentration as needed to ensure quality sequencing runs.

Each sequencing reaction will utilize paired-end sequencing with complete overlap of forward and reverse reads. Each sequenced sample will yield approximately 5Mb of data, with 20-40X coverage using the contractor's sequencing platform. Sequencing the 16S rRNA gene will cover the full-length of the amplicon. Sequencing the 18S rRNA gene for diatoms will cover the full-length of the amplicon or approximately 200 bp using paired-end sequencing.

QA/QC:

The contractor shall comply with QA/QC as required by the NGS platform established by the manufacturer. A copy of the manufacturer's or the contractor's QA/QC specific to the contractor's sequencing platform shall be provided to the EPA WAM. The high-quality reads (Phred 20) shall be a minimum of 85% based on the total number of reads. If the quality is less than 85% and the Phred score is less than 20 the run shall be repeated. Contractor laboratory personnel shall be trained in molecular biology techniques including sample handling, DNA purification and concentration, gel electrophoresis, polymerase chain reaction (PCR), primer preparation, DNA quantification and NGS procedures.

DELIVERABLES

All raw data files that are generated by NGS runs will be sent to the WACOR, including FASTQ files, quality score files and any contig files if produced. Files can be submitted electronically or via airmail on an external drive with back-up files being maintained by the contractor during this work assignment.

ACCEPTANCE PROCEDURE FOR DELIVERABLES

1. Deliverables shall be submitted to the WACOR at the following location:

Attn: Diane Yates
US EPA
1 Sabine Island Drive
Gulf Breeze, FL
32561

Email: yates.diane@epa.gov
Phone: 850-934-9325

Copied to Dr. Stephanie Friedman
Email: friedman.stephanie@epa.gov

2. If any problems arise, the WACOR will advise the contractor within four weeks of receipt of any data. The contractor has six weeks in which to revise or re-run any sequences beginning on the date of contact with the WACOR regarding such data.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-04

☐ Other ☒ Amendment Number: 000002

Contract Number: EP-C-15-010

Contract Period: 09/30/2015 To 09/29/2016

Base X Option Period Number

Title of Work Assignment/SF Site Name: DNA 16S and 18S gene sequencin

Contractor: PEGASUS TECHNICAL SERVICES, INC.

Specify Section and paragraph of Contract SOW: Tasks 1 and 2

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

Period of Performance: From 10/23/2015 To 09/29/2016

Comments:
The purpose of this amendment is to de-scope all tasks.

☐ 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: 09/30/2015 To 09/29/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Diane Yates
(Signature) (Date)
Branch/Mail Code:
Phone Number: 850-934-9325
FAX Number:

Project Officer Name: Michael Moeykens
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-569-7196
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:

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-05

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	To	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X	Option Period Number	Biodeg of oil and protocol dev

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	Section 4-A+B+C+D+E

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

Period of Performance: From 09/30/2015 To 09/29/2016

Comments:
The contractor shall immediately start work on all tasks listed in the Work Assignment Performance Work Statement.

☐ 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 (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: To — 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 Robyn Conmy	(Signature)	(Date)	Branch/Mail Code:
			Phone Number 850-934-9200
			FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7196
			FAX Number:
Other Agency Official Name Maxanne Baldwin	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7962
			FAX Number:
Contracting Official Name Candice Charlton	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-487-2007
			FAX Number:

EP-C-15-010

WA 0-05

Short Title: Biodegradability and toxicity of oil and products

Long Title: Biodegradability and toxicity of oil and dispersants and oil spill product protocol development

WACOR: Robyn Conmy, Ph.D.

Conmy.robyn@epa.gov

513.569.7090

ALT WACOR: Ronald Herrmann

Period of Performance: September 30, 2015 – September 29, 2016

Quality Assurance

All research activities which generate data must follow the guidance of ORD policy and procedures manual section 13.4, *Minimum QA\QC Practices for ORD Laboratories Conducting Research*: PPM 13.4

Research records shall follow the applicable policy for laboratory notebooks, according to ORD policy and procedure manual section 13.2, *Paper Laboratory Records*: PPM 13.2.

When applicable, the contractor shall follow SOPs published by LRPCD at L:\Priv\Cin\NRMRL\LRPCD-SOP\, and SOPs published at the NRMRL@Work SOP webpage: NRMRL SOPs. As SOPs are revised and new SOPs are published, the list of approved SOPs changes, therefore it is important that both web locations be consulted when searching for LRPCD SOPs.

The tasks and subtasks below identify QAPPs which will require revision. QAPP revisions must be reviewed and approved by the LRPCD QA manager before research begins under this contract action.

Section 1-Biodegradation, Toxicity and Chemical Characterization of oils

BACKGROUND

The rising demand, production and shipping of petroleum oils in the U.S. equates to increased risk of spills over land and water. In order to better assess risk to communities and ecosystems, continued research oil weathering, biodegradation rates, toxicity and characterization is needed. Understanding these parameters allows for improved conceptual models dedicated to transport pathways and ultimate fate of spilled oil. Biodegradation is a natural process by which microorganisms such as bacteria, fungi, and yeast break down complex compounds into simpler

products, thus removing oil from the environment. But removal and degradation rates are a function of variations in environmental factors and microbial structure. Beyond this, the toxicity of oils also varies and is influenced by oil type, weathering state, and application of oil spill countermeasure products listed on National Contingency Plan Product Schedule. Needed is further evaluation of toxicity and exposure studies.

TASK 1.1 – Biodegradability of Physically and Chemically Dispersed Endicott oil and Corexit Dispersant at Two Temperatures.

Task 1.1 Relevance and Objective: Biodegradation rates of physically dispersed and chemically dispersed oil are a function of the oil type, dispersant type, microbial community structure and environmental factors (such as temperature). It is critical to have an understanding of how the rates are influenced by these variables. Such information is useful during oil spill response efforts and for fate and transport models. The objective of this task is to determine the biodegradation rates of Endicott Crude oil (a potential future EPA reference oil) when physically and chemically dispersed with Corexit.

Task 1.1 Approach: This task is a continuation of EP-C-11-006, WA 3-33 and results shall be used to compare to the findings found in the previous WA. Analytical methods will include measuring markers of Corexit. Monitoring of oil hydrocarbons will be conducted using high-resolution GC/MS/MS instrumentation. Analytes including all alkanes from n-C10 to n-C35 plus pristane and phytane, all resolvable PAHs ranging from 2- to 4-rings and their alkylated homologs, and hopane shall be quantified. In addition, total petroleum hydrocarbons (TPH) shall be quantified by the EPA standard GC/FID method. The NRMRL lab support contractor Team shall modify the existing Category A QAPP, L-15405, to complete the biodegradation work proposed here. The activities under this task are designated as QA category A.

Task 1.1 Deliverables: Outputs shall be in the form of detailed monthly progress reports, submitted in accordance with the contract, describing progress made in the work assignment subtask. A final report shall be prepared by the Contractor summarizing the results from this study and submitted to the EPA WACOR on or before September 29, 2016. Raw data shall be provided to the EPA WACOR in the form of a Microsoft Excel spreadsheet at the conclusion of each dispersant/temperature/oil combination. The format for the data report shall be provided to the Contractor by the EPA WACOR via written technical direction.

TASK 1.2 – Biodegradability of Diluted Bitumen oil by Anderson Ferry and Kalamazoo River Cultures in Freshwater at Two Temperatures.

Task 1.2 Relevance & Objective: The production and shipping of emerging crude oils has increased substantially in the past 5 years. In turn, this causes increased risk to ecosystems and communities for potential spills. One type of emerging crude, bitumen, poses unique problems for spill response and remediation options. This is due to its high viscosity, which requires dilution prior to transport. Dilution with condensate, diluent or synthetic oil produces 'diluted' and 'synthetic' bitumen (dilbit

and synbit, respectively). Hence the chemical nature of the bitumen various widely, thus evaluating degradation rates, fate and transport models and toxicity is challenging. Under this WA task, biodegradation rates for 2 types of bitumen, Cold Lake and Western Select. Results will inform transport modeling efforts by NRMRL in Ada, OK for the 2010 bitumen spill in the Kalamazoo River (Jim Weaver, lead). The objective is to evaluate the biodegradability of diluted bitumen by freshwater microbial cultures collected from the Kalamazoo River at two temperatures. The activities under this task are designated as QA category B.

Task 1.2 Approach: This task shall follow the Category B QAPP, L-15405. The contractor shall complete a literature review. As part of this task, *Culture Enrichment* shall be needed, where the EPA WACOR will provide two sources of diluted bitumen. The contractor shall grow two cultures whose only carbon source will be dilbit. A *Parametric Study* on Cold Lake and Western Access diluted bitumen oils will be conducted with the cultures obtained in the enrichment. The contractor shall perform a parametric study on the biodegradation rates achievable with dilbit at 5 and 25 ± 2 °C, and numerous time points sampled. For each sampling event, the hydrocarbon content of each bottle shall be determined in terms of alkanes and aromatics according the EPA Method 8270D Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry.

Task 1.2 Deliverables: After completion of the parametric study, the contractor shall prepare at least one manuscript suitable for publishing the results in a peer-reviewed journal. The contractor shall submit all raw data accumulated to date in monthly reports on a spreadsheet file. Samples will also be set aside for future genomic sequencing akin to efforts in Task 1.3 of this WA.

Task 1.3 – Metagenomic Sequencing of Oil Degrading Microbial Communities

Task 1.3 Relevance & Objective: The Office of Research and Development (ORD) is seeking to take advantage of the advances in next generation (NG) sequencing to obtain genetic information for microbial communities relevant to oil degradation. The goal of this research is to better understand biodegradability of oil by differing microbial cultures in deep and surface waters, treated with various dispersants. The overarching goal is to understand if these dispersants and oil dispersed have any significant implications on biodegradation rates. Molecular approaches such as sequencing analysis of phylogenetic genes (e.g., 16S rRNA gene) can provide an idea on the identity of the bacteria inhabiting natural samples. However, these methods provide limited information on the function potential and genetic network of specific microbial populations. To circumvent this, ORD will use NG sequence technologies to better identify the genes associated with different bacterial populations inhabiting enriched/treated mixed cultures. ORD does not currently have the sequencing capabilities required for the completion of this WA task in a timely manner. As a consequence, analytical services are necessary from a laboratory capable of performing the requested sequencing task within the WA PoP, including the use of NG sequencing methods to generate large sequencing databases. The objective of this work assignment task is to conduct next generation sequencing of samples from total microbial community DNA extracted

by EPA personnel, and provide sequencing data in electronic form. The EPA WACOR will provide a total of 860 different samples. Additional samples can be provided to replace any sample as needed (i.e., due to QA/QC failure). Samples will include treatments that vary in oil type (light or medium crudes and diluted bitumen), dispersant and culture type (Kalamazoo River, Gulf of Mexico).

Task 1.3 Approach: The contractor shall complete the following tasks in accordance with the requirements set forth below utilizing QAPP (L-15045-QP-1-5, approved December 2013). A revision to this QAPP is requested to ensure that the procedures in that document related to PCR work (SOPs 7 -10, pp. 75-86) described the actual procedures currently used.

Requested work: (1.4a) DNA manipulation- The contractor shall perform any further purification or concentration of the DNA following standard protocols. Additionally, the contractor shall prepare all the index libraries (one index per sample) required for the completion of the work assignment. *(1.4b) Sequencing* - In order to obtain enough information for each sample, there shall be a minimum of 0.4 to 3 GB of sequence information and each library must be sequenced using pair ends of minimum 100-250 bases in length. The contractor shall perform sequencing using a platform that produces single reads of that length. In order to complete these tasks; EPA personnel will perform the DNA extractions using established protocols under the direction of Jorge SantoDomingo in NRMRL. Samples will be concentrated in DNAse-free tubes at desirable amounts and stored frozen at -20°C until processed by the contractor. Each tube will contain a specific sample that will be used in sequencing reactions performed by the contractor. The WACOR will provide written technical direction to the contractor to sequence a specific number of samples.

The contractor shall comply with next-generation sequencing QA/QC requirements as established by the information manufacturer, which will be provided by the EPA WACOR. The contractor shall provide a minimum of 85% of high quality (Phred 20) reads from the total number of reads required, and depending the sample type a length of 100 – 300 bp per each PE run. The contractor shall establish a new, or modify an existing QAAP to accommodate this work. The activities under this task are designated as QA category B.

Task 1.3 Deliverables: The primary output of these tasks will consist of electronic files containing the sequencing results for 16S rRNA genes, metagenomes, and metatranscriptomes. Each sequencing reaction should generate a minimum of 0.4 to 3GB (gigabases) of pair-end reactions. It is expected that the data will be compatible with publicly available sequencing analysis softwares. The contractor shall store the data in a secure site, and provide the data to the WACOR using a file transfer protocol (FTP) approach or via storage devices such as external drives. Due to the amount of sequences per sample that is required in this WA task, the contractor must have high throughput capabilities. It is estimated that a total of 860 samples will be processed as part of this task. The contractor shall provide an average of 0.4 GB sequences per metagenome sample

and an average of 2-3 GB sequences per metatranscriptome sample. The WACOR anticipates processing 180 metagenomes and 60 metatranscriptomes. The use of an Illumina HiSeq2500 instrument is known to generate the amount of data required in this WA task. For the metagenomes, the Contractor shall use pair-end (PE)100 and PE150 for the metagenomes and metatranscriptomes, respectively. In addition, the contractor shall provide sequences for phylogenetic genes, i.e., 16S rRNA gene, using a MiSeq instrument and a PE250 approach for approximately 620 samples (in the form of barcoded PCR products). No more than 180 samples should be processed per sequencing run to achieve the desired sequencing depth.

As EPA will perform additional bioinformatic analyses, the contractor shall submit all the raw data files, including FastQ files and contigs as well as other files that are normally produced as next generation sequencing runs are produced. Preferentially, the data will be accessed by the WACOR via internet or sent on an external drive via courier. The contractor shall maintain a backup of this data for the entire duration of the work assignment. The data shall be compatible with sequencing analysis software or similar software. The contractor shall deliver at least 25% of the total analytical services every three months. The activities under this task are designated as QA category B.

TASK 1.4 – Physico-Chemical and Toxicological Characterization of Diluted Bitumen and Potential EPA Reference Oils (Endicott and Dorado)

Task 1.4 Relevance & Objective: This work assignment task is aligned with task 1.1 and 1.2 on biodegradation, where the same oil types, concentrations and DORs will be used to interrelate to toxicity. Chemical and physical characterization is also needed in order to predict behavior of bitumen in fresh and saltwater environments. The main objective of this work assignment task is to conduct acute and chronic toxicity tests using two types of bitumen, Cold Lake and Western Select. Chemical characterization of the source oils is also a goal.

Task 1.4 Approach: The approved category B QAAP L-21545-QP-1-0, approved July 2015, will need to be modified for task 1.4 of this WA, to include the method development research activities under this task: (1) method development, (2) physico-chemical characterization of bitumen oils and (3) conducting of toxicity studies. *Method development* - A review of the methods currently listed in the Oil Pollution Act Subpart J regulations (recent proposed amendments) for toxicity of NCP products is requested. This will inform the method development for subsequent toxicity tests. Once the method is established via written technical direction from the EPA WACOR during the first 2 months of the WA, toxicity studies shall be conducted by the contractor.

Toxicity - Both fresh and salt water species (fish and invertebrates) shall be evaluated in the toxicity studies. The contractor shall evaluate two types of bitumen oil. The EPA WACOR will acquire one diluted bitumen oil (dilbit) from the Department of Fisheries and Oceans, Canada. The contractor shall use the standard effluent slow stir WAF (Water Accommodating Fraction) for fresh and salt water toxicity tests, with range finder tests conducted to bracket concentration ranges.

Chemical analyses (TPH – total petroleum Hydrocarbons) for each test will be required. Six tests per oil, acute for lethality and chronic for sublethal, will be required:

Acute - 48 and 96 hr LC50 (fish) and EC50 (invertebrates); dose response
Species: Mysid; Menidia; Fathead; Daphnid

7 day chronic – NOEC and LOEC ('no' and 'lowest' observed effect concentration)
Species: Mysid; Daphnid

Characterization - This work shall include parameters such as aromatic and alkane composition, specific gravity, viscosity, flammability, pour point. For measuring oil hydrocarbons, the contractor shall adapt the EPA standard GC/MS method to the use of a high-resolution GC/MS/MS instrument conducted on all sacrificial samples with oil. Analytes including all alkanes from n-C10 to n-C35 plus pristane and phytane, all resolvable PAHs ranging from 2- to 4-rings and their alkylated homologs, and hopane shall be quantified. In addition, total petroleum hydrocarbons (TPH) shall be quantified by the EPA standard GC/FID method. The activities under this task are designated as QA category B.

Task 1.4 Deliverables: Outputs shall be in the form of detailed monthly progress reports, submitted in accordance with the contract, describing progress made in the work assignment subtask. A final report shall be prepared by the Contractor summarizing the results from this study and submitted to the EPA WAM on or before September 29, 2016. Raw data shall be provided to the EPA WACOR in the form of a Microsoft Excel spreadsheet at the conclusion of each toxicity test and the physico-chemical characterization.

Section 2-Protocol Development for NCP Oil Spill Countermeasure Products
BACKGROUND
The National Oil and Hazardous Substances Pollution Contingency Plan, or National Contingency Plan (NCP), governs the use of surface washing agents (SWAs), oil dispersants, biological additives, and other chemical agents. Currently the NCP requires submittal of toxicity data for all products listed on the NCP Product Schedule. For dispersants and bioremediation agents, effectiveness data are also required after products have undergone testing in accordance with the published testing protocols developed by the U.S. EPA. EPA developed the Baffled Flask Test (BFT) and the Bioremediation Agent Test as standardized measures of effectiveness for these agents. Currently protocols for evaluating the effectiveness of SWAs and solidifiers have not been developed. Having such protocols would aid on-scene coordinators in making informed decisions and enhance the likelihood of a successful clean-up operation. Section 2 of this work assignment contains four sections dedicated to protocol development.

2.1 - Complete Development of a Surface Washing Agent Protocol
Task 2.1 Relevance & Objective: Surface washing agents (SWAs), also known as shoreline cleaning agents, can be used following an oil spill event to enhance the removal of stranded oil from shoreline surfaces. SWAs are designed to facilitate the release of stranded oil from substrate

surfaces and subsequently transfer that oil to near-shore receiving waters. In biologically sensitive areas, cleaning agents should not disperse the oil into the receiving waters or promote oil penetration into permeable shoreline matrices. Once released, the oil should re-coalesce to form a slick that can be recovered through physical containment and mechanical skimming operations. The use of SWAs as a remediation tool is generally recommended when conventional methods cannot be used on shorelines (including mechanical removal technologies, such as high-pressure water washing, hot-water washing, steam cleaning, and physical removal of beach substrate). These conventional techniques are often invasive, impractical, or detrimental to the natural species within the impacted environment. The objective of task 2.1 of this work assignment (WA) is to develop a standardized and reproducible testing protocol to evaluate the cleaning efficiency of SWAs via conducting reproducibility studies of SWA experiments. The activities under this task are designated as QA category A.

Task 2.1 Approach: The contractor shall complete this task utilizing QAPP (L14866) and the SWA QAPP (L10539-QP-1-5).

Oil removal efficiencies for SWA treatments shall be compared to the washing efficiency of water without SWA. Since a good SWA should not disperse oil into water, the dispersability of each SWA will be evaluated separately using the Baffled Flask Test (BFT). Protocol experiments shall be conducted using Prudhoe Bay Crude (PBC), a medium crude oil. Additionally, a subset of experiments will be conducted using two potential new EPA reference oils that will be established in FY16 dependent on selection by Office of Emergency Management. The EPA WACOR will specify the two oils via written technical direction, and will provide them to the contractor, who will continue research by conducting SWA experiments. The contractor shall use sand and gravel inside metal wire baskets to test the ability of SWAs to remove oil adhered to the surface. Oils will be added in a gridded droplet formation to sand or gravel within the baskets. After a weathering time (approx. 18 hours), SWA will be added to oil droplets with varying SOR (SWA to Oil Ratio), SWA dilution, contact time, water rinse volume and drain time. Testing will be conducted on at least 15 commercial SWA products that EPA has in its possession. The water and washed oil will be collected in a beaker, and the amount collected will be extracted in dichloromethane (DCM) and measured by the spectrophotometric method (at three different wavelengths, 340, 370, and 400 nm) used in the previous work assignments under EPC11006 (WA 0-5, WA 1-05, WA 3-05).

The contractor shall extract the amount of oil remaining on the sand grains or gravel separately and measure in the same manner. A mass balance should result when the amount of oil still embedded in the sand or gravel is summed with the amount washed into the receiving beaker. The contractor shall perform the above experiment in a factorial manner in replicate. The variables are SWA, oil types, oil drip-drying time, exposure time to SWA, and washing time. Temperature will at room temperature. Controls that receive no SWA, just water, shall also be analyzed. Water will be the artificial seawater (GP2) formulation. For additional information on experimental parameters, refer to the dissertation by Dr. Karen Koran, University of Cincinnati. The activities under this task are designated as QA category A.

2.2 – Dispersant Effectiveness using the BFT Dispersant Protocol

Task 2.2 Relevance & Objective: The use of dispersants is typically limited to open sea situations, where dispersion of the oil into the water column shifts the environmental impact of a spill from ocean surface to the water column. The addition of dispersants allows for the formation of smaller oil droplets which can be respired by microbial populations. The objective of this WA task is to conduct a series of Baffle Flask Tests (BFT) using a variety of crude oils including potential EPA reference oils, Endicott and Dorado. Testing will also include investigations over a range of salinities from 0 (freshwater) to up to 90 PSU (hypersaline waters) for a more comprehensive look at the effect of salinity on dispersant effectiveness (DE). In addition to UV-VIS detection typically used, fluorescence techniques will be investigated to determine their appropriateness in determining DE.

Task 2.2 Approach: The contractor shall complete the following task utilizing an approved QAPP; QA ID L14866-QP-1-6. This QAPP will be modified for inclusion of a wider salinity range and fluorescence methods. This WA builds upon previous efforts under EPC11006 (WA 03_05 and 04-05) that evaluated the mixing energy in the BFT when operated at 250 rpm and with 180 ml of seawater in the flask. In the older BFT, the mixing energy was determined at 200 rpm and 120 ml volume. Under EPC11006 WA3-05 and 04_05 , the contractor conducted the BFT at both mixing speeds (180 and 250 rpm) and volumes (120 and 180 ml) on a rotary shaker in a constant temperature room at 25 °C± 2 °C and 5 ± 0.5 °C using the two new reference oils. Replicates were tested to determine the pass-fail decision criteria at each of the testing conditions. Corexit 9500 and finasol were used to establish the pass-fail rules at different dispersant-to-oil ratios (DORs; 1:25, 1:50, 1:100 and 1:200). In this new WA 0-05, the contractor shall work under this effort to obtain results that will assist in final determination of the pass-fail criteria. The activities under this task are designated as QA category A.

2.3 – Complete Development of Solidifier Protocol

Task 2.3 Relevance & Objective: Solidifiers are products composed of dry high molecular weight polymers that have a porous matrix and large oleophilic surface area. Solidifiers form a physical bond with the oil. When applied to spilled oil, the oil viscosity increases to the point that it becomes solidified into a rubberlike solid. The end product can range from a firm cohesive mass to a noncohesive granular material. Solidifiers are available in various forms, including dry powder, granules, semisolid materials (e.g., pucks, cakes, balls, sponge designs), and contained in booms, pillows, pads, and socks. Solidifier products are listed on the NCP Product schedule, but currently no universal protocol for testing their effectiveness exists. The objective of this work assignment task is to develop and conduct a round robin experiment to evaluate solidifier efficacy protocol proposed in under EPC11006; QAPP ID L11068.

Task 2.3 Approach: The contractor shall develop a revised QAPP using the existing QA ID -L-10197-QP-1-8, approved July 2015. This work is a continuation of the parametric study of solidifier efficacy conducted in WA 03-23. Previously, two oils were exposed to 10 solidifiers at 2 temperatures (25 °C± 2 °C and 5 ± 0.5 °C) and 1 SOR (1:2). The six replicates were conducted at fixed mixing speed (60 rpm) and water type (fresh water). In section 2.3 of this WA 0-05, a round robin experiment shall be developed and conducted to test the robustness of this method. The

contractor shall evaluate the effects of operator, SOR, temperature and solidifier type on effectiveness. The activities under this task are designated as QA category A.

2.4 – Testing of Bioremediation Products using NCP Bioremediation Agent Protocol

Task 2.4 Relevance & Objective: Just like dispersants, solidifiers and surface washing agents, bioremediation products are listed on the National Contingency Plan Product Schedule. However, bioremediation agents and dispersants are the only categories that currently require effectiveness testing. The objective of this WA task is to begin evaluating the current effectiveness test for possible modifications for improvement. A portion of this task will be literature review of the existing test and data that is publicly available, followed by limited laboratory analysis of the test on crude oils available in the EPA lab facility.

Task 2.4 Approach: The contractor shall develop a new Category A QAPP to cover the existing bioremediation testing for listing on the National Contingency Plan Product Schedule. The Contractor shall evaluate the pass-fail criteria of bioremediation agents in planning for exploratory experiments to evaluate the existing testing protocol on the NCP Product Schedule. The activities under this task are designated as QA category A.

Overarching TASK 2 DELIVERABLES

The contractor shall provide raw data to the EPA WACOR in the form of a spreadsheet for each monthly report and at the completion of Task 2. These spreadsheets will contain the raw data from the surface washing agent, dispersant and solidifier sub tasks. At the end of the WA period of performance, the contractor shall submit a report to the EPA WACOR for use toward a publication in a peer-reviewed journal.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-08

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	To	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X	Option Period Number	Biocontain. Suite Lab Support

Contractor: PEGASUS TECHNICAL SERVICES, INC.

Specify Section and paragraph of Contract SOW: 4A, 4D3

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

Period of Performance: From 10/01/2015 To 09/30/2016

Comments:
The contractor shall immediately start work on all tasks listed in the Work Assignment Performance Work Statement.

☐ 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 (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: To — 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 Vincente Gallardo	(Signature)	(Date)	Branch/Mail Code:
			Phone Number 513-569-7176
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Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7196
			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
Work Assignment# 0-08
CONTRACT EP-C-15-010

Title: Biocontainment Suite Laboratory Support

Work Assignment Contracting Officer's Representative: Vicente Gallardo 513-569-7176

Alternate WACOR: Gene Rice 513-569-7204

Period of Performance: CO Issuance through 09/29/2016

Introduction

There is currently a need for detection and decontamination systems for biological contaminants that could be used as weapons of terrorism against the nation's water supplies and buildings. The U.S. Environmental Protection Agency's (EPA) National Homeland Security Research Center (NHSRC) is committed to developing and widely distributing methods for the detection, and deactivation of biological agents in water as well as the decontamination of water systems, and building materials and surfaces. In addition, NHSRC needs to develop methods for isolating, purifying, and detecting biological agents like *Bacillus anthracis* spores and *Francisella tularensis* in soil. The ultimate objective of this research effort is to produce standardized, effective, validated methods to guide the collection, preparation and analysis of water, soil, and surface samples. A number of methods for collecting samples from surfaces will be evaluated. These methods include the use of wipes, swabs and HEPA socks. Water sampling will include evaluation of an ultrafiltration microbial concentration device. Analytical methods include culture assay and Polymerase Chain Reaction (PCR). Soil samples might be concentrated and purified using buoyant density floatation or other techniques. Studies of the inactivation of bacterial endospores using steam sterilization and chlorine bleach may be required. Biological contaminants of concern include bacterial endospores, vegetative bacteria, viruses, and protozoa cysts, spores, and oocysts.

The purpose of this work assignment is to secure technical services for NHSRC to develop and test sampling and analytical methods, as well as develop deactivation and decontamination methods. Services will be specified through written technical directives issued by the EPA Contract Level Contracting Officer's Representative (COR) or EPA Work Assignment Contracting Officer's Representative (WACOR).

Task 1: Quality Assurance Requirements

Task 1a Prepare / Update Project Specific Quality Assurance Project Plans (QAPP)

QA-Level: B

The QAPPs shall be prepared by the contractor and submitted to the EPA WACOR.

The contractor shall prepare and/or update project specific Quality Assurance Project Plans with Quality Assurance (QA) Category B. Attachment 1 to the Performance Work Statement (PWS) provides information regarding NHSRC QA Requirements/Definitions List.

The QAPP(s) must be approved by the EPA WACOR prior to the start of any subsequent work. This research effort shall be developed in accordance with the minimum QA requirements.

Task 1b: AWBERC Biocontainment Suite Facility Manual

The contractor shall fulfill the requirements specified in the AWBERC Biocontainment Suite Facility Manual. The contents of this manual include the following elements:

- Revise as needed the existing document for EPA managers and facility personnel that describes the facility operations and capabilities
- Revise as required the descriptions of laboratory facilities and equipment
- Describe and draft every day operating protocols for EPA and contractor staff
- Document facility's chain of command, personnel responsibilities, and training requirements
- Document quality assurance and quality control requirements
- Collect into one document repetitive information required in project planning documents (such as Quality Assurance Project Plans (QAPP), Safety Plans, Laboratory SOPs, etc.)
- Improve operating efficiency by establishing basic record keeping requirements
- Provide a record of maintenance requirements for equipment in the laboratory
- Describe day to day housekeeping requirements for the laboratory such as biohazard waste disposal

For individual research projects, this manual must be supplemented by an approved project-specific QAPP and Operating Procedure. The QAPP(s) must be approved by the EPA WACOR and the NHSRC Director of Quality Assurance prior to any data collection activity. Any revisions of this AWBERC Biocontainment Suite Facility Manual will not be submitted for EPA publication; however, the document will go through the NHSRC clearance process.

Task 2: Prepare / Update Health and Safety Plan (HASP).

The HASP will be provided by the EPA WACOR. *De novo* HASPS and modifications or updates to current HASPs shall be prepared by the contractor.

Task 3: Work / Experimental Requirements

The contractor shall conduct the research work as described in this Performance Work Statement

(PWS). Services shall be performed at the Andrew W. Breidenbach Environmental Research Center (AWBERC), and the Test and Evaluation Facility according to the specific requirements of the experiments. The specific work areas associated with this scope of work include: 1) literature review of sampling and analytical methods, 2) methods development, 3) document methods with written standard operating procedures, 4) sampling and analytical support (field and laboratory), 5) sample preparation, 6) obtain sufficient expendable supplies for the smooth operation of the laboratory, 7) keep the laboratory organized, decontaminated, and clean, 8) transcription of electronic data from one software program to another as needed, 9) data analysis and reporting, and 10) report/manuscript preparation.

The contractor shall conduct the following sub-tasks in support of the sampling and laboratory methods development, following approved Quality Assurance Project Plans.

A. Complete the RV-PCR experiments with *Francisella tularensis* that were initiated under contract EP-C-11-006, WA 4-08.

B. Complete the development of procedures for the sampling and analysis of *Bacillus* spores in soil. This work was carried out under contract EP-C-11-006, WA 4-08.

C. Mature, drinking water (DW) biofilms will be established on copper surfaces within biofilm annular reactors under similar conditions found within residential households (e.g. DW flow rate, usage, temperature, plumbing material). DW quality characteristics, such as levels of metals, disinfectant residual, heterotrophic plate counts (HPC), and inorganic and organic compounds, will be monitored throughout the experiment. Once DW biofilms are established, Legionella pneumophila strain Philadelphia-1 (Lp), will be introduced into each reactor to allow Lp colonization of the biofilm material. Lp, as well as naturally-occurring Legionella and Mycobacterium background levels, within the DW biofilms will be quantified using both culture and molecular methods. Microbial quantification will be conducted both before and after biofilm exposure to two different disinfectants: chlorine (Cl_2) and copper/silver ions (Cu/Ag). Biofilm samples will also be used for protein, adenosine triphosphate, and HPC analysis to quantify biofilm material, microbial activity, and level of indigenous DW microbes, respectively. Total genomic DNA extracted from biofilms before and after Lp colonization and Cl_2 and Cu/Ag exposure will also be used for metagenomic analysis to assess putative changes in bacterial diversity and relative abundance.

D. Conduct experiments to evaluate the recovery of microorganisms (*Bacillus* spores) during the concentration of water laden with particulate matter. A QAPP (*Evaluation of a Concentration Process for Microorganisms in Large Volumes of Turbid Water Using Tangential Flow Ultrafiltration*, Approved March 2014) and a HASP (#: 2014-017) have already been approved.

E. Test methods for inactivation of biological contaminants in water and on surfaces. Included in this task is the evaluation of a bench scale procedure that has been drafted but not tested. The procedure had been developed to provide emergency management personnel with a simple but accurate test to measure the efficacy of chlorine bleach for inactivating pathogenic microorganisms in wash water that would be generated during a cleanup of a site contaminated

with biological agents.

In support of task 3, subtasks, E – F, the contractor shall also carry out the following sub-tasks as needed.

F. Test viral and bacterial culture methods and molecular methods for detection of biological organisms. Researchers must be willing and able to work in BSL-2 or BSL-3 laboratory environments following all safety standards.

G. Perform classical cell enumeration using a hemocytometer and/or standard serial dilution techniques.

H. Use a Becton Dickinson FACSaria II (U.S. EPA flow cytometer that is available for contractor use) to count and sort microorganisms. Enumeration and sorting includes bacterial endospores, protozoan spores, cysts, and oocyst, as well as bacterial vegetative cells, is required. Specialized training, which is to be provided by the manufacturer, will be required.

I. Provide field and laboratory support for the testing of sampling and sample preparation protocols.

J. Perform microscopy techniques for identification of protozoa and bacteria including preparation of specimens using a variety of techniques (staining, smear preparation, wet mount, fluorescent antibody staining). Optical systems to be utilized include bright field, phase contrast, epifluorescence, and differential interference contrast microscopy. Photomicrographic documentation will also be required on occasion.

K. Knowledge and ability to perform sterilization techniques such as autoclaving, dry heat sterilization, and vaporous hydrogen peroxide sterilization of heat labile materials will be required.

L. Since work in a BSL-2 or BSL-3 laboratory environment will be required, routine cleaning of floors, biosafety cabinets, and laboratory bench tops with disinfectants is an obligatory requirement.

M. Because safety is a primary concern, personal protective equipment, which includes at a minimum, safety glasses, gowns, and gloves must be worn while working in the BSL-2 or BSL-3 laboratory. While laboratory notebooks must be present and maintained in the BSL-2 or BSL-3 laboratory, excessive accumulations of paper is to be kept to a minimum in the BSL-2 or BSL-3 laboratory.

Task 4: Progress meetings

These meetings will be held on an 'as needed' basis with Vicente Gallardo, the WACOR, and/or Eugene Rice, alternate WACOR for this work assignment.

Additional personnel requirements

1) Candidates must demonstrate, at a minimum, three years lab experience in microbiology
2) Demonstrated experienced with one or more of the following: aseptic techniques, cell enumeration, viral and/or bacterial culture methods, and polymerase chain reaction (PCR) techniques
3) Willingness to work in appropriate personal protective equipment in BSL-2 or BSL-3 laboratories following all safety requirements
4) Candidate must be able to work in blocks of time of no less than 4 consecutive hours
5) Candidates must be willing to receive vaccinations as required.

Expected Outputs/Performance Measures:
Depending on experimental results of this work assignment, the possibility exists that the contractor may generate reports, draft publications, suggest experimental designs, create standard operating procedures, and/or submit data spreadsheets. These experimental outputs will be requested by written technical direction from the EPA WACOR. It is difficult to anticipate research/experimental results, the number/content of these outputs, or if revisions shall be necessary. If the contractor shall be assigned significant output responsibilities, a work assignment amendment will be submitted prior to the start of that output.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-08

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	09/30/2015 To 09/29/2016 Base X Option Period Number	Bio. Suite Lab support

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	4A, 4D3

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

Period of Performance: From 10/01/2015 To 09/29/2016

Comments:
The purpose of this amendment is to add a new subtask, E, under task 3 to the performance work statement; and to replace Gene Rice with Eric Rhodes as the alternate WACOR.

☐ 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
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Authorized Work Assignment Ceiling

Contract Period: 09/30/2015 To 09/29/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Vincente Gallardo	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-569-7176 FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-569-7196 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
Contract EP-C-15-010
WA 0-8, Amendment 1

Title: Biocontainment Suite Laboratory Support

Work Assignment Contracting Officer's Representative (WACOR):
Vicente Gallardo
Water Infrastructure and Protection Division
National Homeland Security Research Center
Mail Stop NG-16
Cincinnati, Ohio 45268
Phone: 513-569-7176

Alternate WACOR: Eric Rhodes, 513-569-7308

Project Period: CO Issuance through 09/30/16

Purpose:

The purpose of this amendment is to add a new subtask, E, under task 3. Due to the structure of the original work statement, task 3 is given in its entirety. The additional task is given below in red and underlined. All other tasks and outputs remain the same. Eric Rhodes will serve as alternate WACOR and will replace Gene Rice.

Task 3: Work / Experimental Requirements

The contractor shall conduct the research work as described in this Performance Work Statement (PWS). Services shall be performed at the Andrew W. Breidenbach Environmental Research Center (AWBERC), and the Test and Evaluation Facility according to the specific requirements of the experiments. The specific work areas associated with this scope of work include: 1) literature review of sampling and analytical methods, 2) methods development, 3) document methods with written standard operating procedures, 4) sampling and analytical support (field and laboratory), 5) sample preparation, 6) obtain sufficient expendable supplies for the smooth operation of the laboratory, 7) keep the laboratory organized, decontaminated, and clean, 8) transcription of electronic data from one software program to another as needed, 9) data analysis and reporting, and 10) report/manuscript preparation.

The contractor shall conduct the following sub-tasks in support of the sampling and laboratory methods development, following approved Quality Assurance Project Plans.

A. Complete the RV-PCR experiments with *Francisella tularensis* that were initiated under contract EP-C-11-006, WA 4-08.

B. Complete the development of procedures for the sampling and analysis of *Bacillus* spores in soil. This work was carried out under contract EP-C-11-006, WA 4-08.

C. Mature, drinking water (DW) biofilms will be established on copper surfaces within biofilm annular reactors under similar conditions found within residential households (e.g. DW flow rate, usage, temperature, plumbing material). DW quality characteristics, such as levels of metals, disinfectant residual, heterotrophic plate counts (HPC), and inorganic and organic compounds, will be monitored throughout the experiment. Once DW biofilms are established, Legionella pneumophila strain Philadelphia-1 (Lp), will be introduced into each reactor to allow Lp colonization of the biofilm material. Lp, as well as naturally-occurring Legionella and Mycobacterium background levels, within the DW biofilms will be quantified using both culture and molecular methods. Microbial quantification will be conducted both before and after biofilm exposure to two different disinfectants: chlorine (Cl_2) and copper/silver ions (Cu/Ag). Biofilm samples will also be used for protein, adenosine triphosphate, and HPC analysis to quantify biofilm material, microbial activity, and level of indigenous DW microbes, respectively. Total genomic DNA extracted from biofilms before and after Lp colonization and Cl_2 and Cu/Ag exposure will also be used for metagenomic analysis to assess putative changes in bacterial diversity and relative abundance.

D. Conduct experiments to evaluate the recovery of microorganisms (*Bacillus* spores) during the concentration of water laden with particulate matter. A QAPP (*Evaluation of a Concentration Process for Microorganisms in Large Volumes of Turbid Water Using Tangential Flow Ultrafiltration*, Approved March 2014) and a HASP (#: 2014-017) have already been approved.

E. Conduct experiments with dead-end hollow-fiber ultrafiltration (D-HFUF). In conjunction with subtask D, Contractor shall perform experiments to evaluate and develop a method to concentrate turbid waters (e.g., decon wash water, artificial turbid waters, surface water or wastewaters) using dead-end hollow-fiber ultrafiltration. The contractor shall amend the QAPP and HASP mentioned in subtask D to include the work with D-HFUF. The dead-end hollow-fiber ultrafiltration (D-HFUF) method shall be setup in the laboratory and proficiency in the procedure shall be demonstrated using MS2 bacteriophage by the Pegasus personnel. The recovery of microorganisms shall be evaluated during the performance experiments. Microorganisms can include but are not limited to *Bacillus* spores, *E. coli*, Enterococci, MS2 coliphage, and Phi6 bacteriophage. Due to the high turbidity of the retentate samples the assays for quantifying the microorganisms may need to be developed and evaluated to clean up the sample enough for quantification. The loss during this processing step shall be reported in the overall recovery of the method. It is not necessary for this work to be performed in a BSL-3 laboratory.

D-HFUF shall be used to concentrate large volumes of turbid waters (5 - 50 liter) using an established procedure which will be provided to the Contractor. The procedure may need to be changed and updated during the evaluation of this method for the waters and organism used during the experiments. Note that the pump drive, pump head, and tubing mentioned in the procedure can be substitited for an equivalent product. The particular filter outlined in the procedure shall be used. The filtration rate and chemical makeup of the elution solution may need to be altered depending on their experimentally determined effect on the target organisms.

F. Test methods for inactivation of biological contaminants in water and on surfaces. Included in this task is the evaluation of a bench scale procedure that has been drafted but not tested. The procedure had been developed to provide emergency management personnel with a simple but accurate test to measure the efficacy of chlorine bleach for inactivating pathogenic microorganisms in wash water that would be generated during a cleanup of a site contaminated with biological agents.

In support of task 3, subtasks, A – F, the contractor shall also carry out the following sub-tasks as needed.

G. Test viral and bacterial culture methods and molecular methods for detection of biological organisms. Researchers must be willing and able to work in BSL-2 or BSL-3 laboratory environments following all safety standards.

H. Perform classical cell enumeration using a hemocytometer and/or standard serial dilution techniques.

I. Use a Becton Dickinson FACSaria II (U.S. EPA flow cytometer that is available for contractor use) to count and sort microorganisms. Enumeration and sorting includes bacterial endospores, protozoan spores, cysts, and oocyst, as well as bacterial vegetative cells, is required. Specialized training, which is to be provided by the manufacturer, will be required.

J. Provide field and laboratory support for the testing of sampling and sample preparation protocols.

K. Perform microscopy techniques for identification of protozoa and bacteria including preparation of specimens using a variety of techniques (staining, smear preparation, wet mount, fluorescent antibody staining). Optical systems to be utilized include bright field, phase contrast, epifluorescence, and differential interference contrast microscopy. Photomicrographic documentation will also be required on occasion.

L. Knowledge and ability to perform sterilization techniques such as autoclaving, dry heat sterilization, and vaporous hydrogen peroxide sterilization of heat labile materials will be required.

M. Since work in a BSL-2 or BSL-3 laboratory environment will be required, routine cleaning of floors, biosafety cabinets, and laboratory bench tops with disinfectants is an obligatory requirement.

N. Because safety is a primary concern, personal protective equipment, which includes at a minimum, safety glasses, gowns, and gloves must be worn while working in the BSL-2 or BSL-3 laboratory. While laboratory notebooks must be present and maintained in the BSL-2 or BSL-3 laboratory, excessive accumulations of paper is to be kept to a minimum in the BSL-2 or BSL-3 laboratory.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-09

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X To Option Period Number	AOP treatment of water

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	4(A)3 Chemical treatment processes

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

Period of Performance: From 11/04/2015 To 01/29/2016

Comments:
The contractor is authorized to start work on all parts of this work assignment immediately.

☐ 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 (Max 7)
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Authorized Work Assignment Ceiling

Contract Period: To — 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 Matthew Magnuson	(Signature)	(Date)	Branch/Mail Code: Phone Number 513-569-7321 FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-569-7196 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

AOP treatment of water for POTW acceptance

Contract Number:	**EP-C-15-010**
Work Assignment Number:	**0-09**
Contractor:	**Pegasus Technical Services, Inc.**
Period of Performance:	**CO Issuance through September 29, 2016**
Work Assignment Manager:	**Matthew Magnuson (NHSRC)**
Alternate Work Assignment Manager:	**Stuart Willison (NHSRC)**
Project Site:	**AWBERC**

PURPOSE

This work assignment will include assistance in preparation of reports and/or journal articles from data previously collected under an approved Quality Assurance Project Plan "Investigation of advanced oxidation processes (AOP) for the treatment and disposal of drinking water contaminated with toxic chemicals into public sewer (collection) systems". The number of reports and/or journal articles is expected to be 2-5, with the exact number depending on available data.

BACKGROUND

The EPA's National Homeland Security Research Center (NHSRC) conducts research to protect, detect, respond to, and recover from terrorist attacks on the nation's water and wastewater infrastructure. The Water Infrastructure Protection Division, conducts research on the treatment of public drinking water purposely contaminated with toxic industrial chemicals, pesticides, or chemical warfare agents. The intent is to expeditiously and safely clean up the drinking water system and get things back to normal operation. As a preferred approach, the contaminated water would be treated and then discharged to the public sewer system. A potential concern is that the waste water, although adequately treated to remove the contaminant of human health concern, will contain hazardous by-products or other constituents toxic to microorganisms used in the waste water treatment process. On at least two recent occasions, public sewer systems have refused to accept treated water and it had to be hauled to

another location. A contamination event resulting in thousands of gallons of water will make this infeasible. Sufficient experimental data must be available to convince local and state officials charged with making tough decisions on the clean-up and disposal of contaminated water in the event of such an attacks. This data should be aimed at goals of protecting human health while ensuring continuity of operation of the waste water treatment plant, which is infrastructure critical to both 1) ensuring sanitation and public health and 2) continuing clean-up operations from the contamination event.

EPA utilized a previous Work Assignment (Contract number EP-C-11-006, Work Assignment 4-09) to increase the scientific understanding of using ozone with hydrogen peroxide, as well as other AOPs, to break down chemical contaminants to something relatively nontoxic and suitable for public sewer discharge. Additional knowledge in this area will be useful to water utilities and other decision-makers in assessing impacts of discharge to the sewer treatment plan of water purposefully or accidentally contaminated with toxic industrial chemicals, pesticides, or chemical warfare agents.

The previous Work Assignment (Contract number EP-C-11-006, Work Assignment 4-09) involved studying the reaction between chemical contaminants of interest and AOPs, such as ozone with hydrogen peroxide. This research will look at the effectiveness of using ozone with hydrogen peroxide, as well as other AOPs, to break down the contaminant to something relatively nontoxic and suitable for public sewer discharge. Suitability for public sewage discharge will be assessed through testing of the water destined for sewer discharge for the ability of the potentially discharged water to impact the ability of the microorganism within the sewage treatment plant to continue to perform their intended function of breaking down "normal" plant influents.

Much useful data was collected under the previous work assignment under an approved Quality Assurance Project Plan (QAPP, NHSRC QA Project Number 32_2012_QAPP.WIPD), these data and the QAPP will be provided to the contractor.

This Performance Work Statement (PWS) describes reporting that data through reports and/or journal articles. The following detailed task description describes the preparation of two (initial) papers, and a plan for additional experiments, reports, and reporting activities which may become evident as these documents are developed.

DETAILED TASK DESCRIPTIONS

Task 1 – Preparation of papers

The contractor shall assist in the drafting of papers by 1) developing the "methods and materials" section in a manner typical for peer reviewed journal publication and 2) supplying EPA with noteworthy observations regarding the data suitable for inclusion in the results section. EPA will incorporate these items into the draft of the paper prepared by EPA.

Upon CO issuance of award, the contractor will have 10 working days to provide these items to the EPA WACOR. The EPA WACOR will review and provide comments to the contractor within 7 days. The Contractor would then address comments and send the EPA WACOR a revised draft within 7 days.

This process will be repeated for the subsequent papers, with the timeline for the second paper starting no later than completion of the first paper.

In the course of preparing the two papers, it may become evident that additional experiments are necessary to obtain final data for the document(s). In this case, in accordance with the previously developed QAPP, the contractor after receiving written technical direction from the WACOR shall conduct appropriate experiments, but shall not duplicate previous experiments. The experiments are described in Task 1a.

DELIVERABLE:

- The items described in the task description, suitable for submission to a peer reviewed journal. Details of the timeline for each paper may follow the description above, but will be adjusted to the results of Tasks 1a.

Task 1a – Additional experiments

In the course of the activities in Task 1, it is likely that some additional experiments will need to be performed to provide data to support completion of the papers. This task generates additional data sufficient to complete the documents in all tasks of this PWS.

These potentially needed experiments are described in the QAPP (NHSRC QA Project Number 32_2012_QAPP.WIPD) developed for the previous work assignment (Contract number EP-C-11-006, Work Assignment 4-09). This QAPP described treatment of water samples with AOP technologies. The toxicity of treated water may be assessed using a nitrification inhibition (NI) test. Additional toxicity testing using a Microtox® toxicity test will also be employed to indicate possible ecotoxicity of the treated water (post AOP treatment). The results from these tests will help EPA make decisions about how to treat and dispose of water contaminated with toxic chemicals.

It is anticipated that the QAPP developed for the previous work assignment (Contract number EP-C-11-006, Work Assignment 4-09) will be sufficient or can be modified with minimal effort. For costing purposes, the contractor shall assume that the level of effort is equivalent to evaluation of three AOP technologies with one contaminants in one source of water, and that NI tests will not need performed.

DELIVERABLE:

- Data to support development of papers described in Tasks 1, it is anticipated that all deliverables will be completed by **Jan. 31, 2016**

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-09

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	09/30/2015 To 09/29/2016 Base X Option Period Number	AOP treatment of water

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	remains unchanged

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

Period of Performance: From 11/04/2015 To 09/29/2016

Comments:
Increase the number of source of waters to be used in experiments in Task 1 from one to three. Period of Performance is extended to Sept 29, 2016.

☐ 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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3										
4										
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Authorized Work Assignment Ceiling

Contract Period: 09/30/2015 To 09/29/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Matthew Magnuson	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7321 FAX Number:
Project Officer Name Michael Moeykens	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7196 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
Contract No. EP-C-15-010
WA 0-09, Amendment 1

Title: AOP treatment of water for POTW acceptance

Work Assignment Manager (WAM):

Matthew L. Magnuson, Ph.D.
US Environmental Protection Agency
National Homeland Security Research Center
Water Infrastructure Protection Division
26 W. Martin Luther King Dr.
Mailstop: NG-16
Cincinnati, OH 45268
telephone: 513-569-7321
fax: 513-487-2559

Project Period: CO Issuance through September 29, 2016

Purpose:

The purpose of this amendment is to increase the number of source of waters to be used in experiments from one to three. Based on completed experiments under the WA, it will be necessary to complete experiments with at least one additional source water to complete the study. No previous work (with the original source water) will be repeated. All other tasks and outputs remain the same. Revisions to the PWS are in track changes below. The Period of Performance end date is extended to Sept 29, 2016.

Revised PWS:

PERFORMANCE WORK STATEMENT

AOP treatment of water for POTW acceptance

Contract Number:	EP-C-15-010
Work Assignment Number:	0-09
Contractor:	Pegasus Technical Services, Inc.
Period of Performance:	CO Issuance through September 29, 2016

Work Assignment Manager: **Matthew Magnuson (NHSRC)**

Alternate Work Assignment Manager: **Stuart Willison (NHSRC)**

Project Site: **AWBERC**

PURPOSE

This work assignment will include assistance in preparation of reports and/or journal articles from data previously collected under an approved Quality Assurance Project Plan "Investigation of advanced oxidation processes (AOP) for the treatment and disposal of drinking water contaminated with toxic chemicals into public sewer (collection) systems". The number of reports and/or journal articles is expected to be 2-5, with the exact number depending on available data.

BACKGROUND

The EPA's National Homeland Security Research Center (NHSRC) conducts research to protect, detect, respond to, and recover from terrorist attacks on the nation's water and wastewater infrastructure. The Water Infrastructure Protection Division, conducts research on the treatment of public drinking water purposely contaminated with toxic industrial chemicals, pesticides, or chemical warfare agents. The intent is to expeditiously and safely clean up the drinking water system and get things back to normal operation. As a preferred approach, the contaminated water would be treated and then discharged to the public sewer system. A potential concern is that the waste water, although adequately treated to remove the contaminant of human health concern, will contain hazardous by-products or other constituents toxic to microorganisms used in the waste water treatment process. On at least two recent occasions, public sewer systems have refused to accept treated water and it had to be hauled to another location. A contamination event resulting in thousands of gallons of water will make this infeasible. Sufficient experimental data must be available to convince local and state officials charged with making tough decisions on the clean-up and disposal of contaminated water in the event of such an attacks. This data should be aimed at goals of protecting human health while ensuring continuity of operation of the waste water treatment plant, which is infrastructure critical to both 1) ensuring sanitation and public health and 2) continuing clean-up operations from the contamination event.

EPA utilized a previous Work Assignment (Contract number EP-C-11-006, Work Assignment 4-09) to increase the scientific understanding of using ozone with hydrogen peroxide, as well as other AOPs, to break down chemical contaminants to something relatively nontoxic and suitable for public sewer discharge. Additional knowledge in this area will be useful to water utilities and other decision-makers in assessing impacts of discharge to the sewer treatment plan of water

purposefully or accidentally contaminated with toxic industrial chemicals, pesticides, or chemical warfare agents.

The previous Work Assignment (Contract number EP-C-11-006, Work Assignment 4-09) involved studying the reaction between chemical contaminants of interest and AOPs, such as ozone with hydrogen peroxide. This research will look at the effectiveness of using ozone with hydrogen peroxide, as well as other AOPs, to break down the contaminant to something relatively nontoxic and suitable for public sewer discharge. Suitability for public sewage discharge will be assessed through testing of the water destined for sewer discharge for the ability of the potentially discharged water to impact the ability of the microorganism within the sewage treatment plant to continue to perform their intended function of breaking down "normal" plant influents.

Much useful data was collected under the previous work assignment under an approved Quality Assurance Project Plan (QAPP, NHSRC QA Project Number 32_2012_QAPP.WIPD), these data and the QAPP will be provided to the contractor.

This Performance Work Statement (PWS) describes reporting that data through reports and/or journal articles. The following detailed task description describes the preparation of two (initial) papers, and a plan for additional experiments, reports, and reporting activities which may become evident as these documents are developed.

DETAILED TASK DESCRIPTIONS

Task 1 – Preparation of papers

The contractor shall assist in the drafting of papers by 1) developing the "methods and materials" section in a manner typical for peer reviewed journal publication and 2) supplying EPA with noteworthy observations regarding the data suitable for inclusion in the results section. EPA will incorporate these items into the draft of the paper prepared by EPA.

Upon CO issuance of award, the contractor will have 10 working days to provide these items to the EPA WACOR. The EPA WACOR will review and provide comments to the contractor within 7 days. The Contractor would then address comments and send the EPA WACOR a revised draft within 7 days.

This process will be repeated for the subsequent papers, with the timeline for the second paper starting no later than completion of the first paper.

In the course of preparing the two papers, it may become evident that additional experiments are necessary to obtain final data for the document(s). In this case, in accordance with the previously developed QAPP, the contractor after receiving written technical direction from the WACOR shall conduct appropriate experiments, but shall not duplicate previous experiments. The experiments are described in Task 1a.

DELIVERABLE:

- The items described in the task description, suitable for submission to a peer reviewed journal. Details of the timeline for each paper may follow the description above, but will be adjusted to the results of Tasks 1a.

Task 1a – Additional experiments

In the course of the activities in Task 1, it is likely that some additional experiments will need to be performed to provide data to support completion of the papers. This task generates additional data sufficient to complete the documents in all tasks of this PWS.

These potentially needed experiments are described in the QAPP (NHSRC QA Project Number 32_2012_QAPP.WIPD) developed for the previous work assignment (Contract number EP-C-11-006, Work Assignment 4-09). This QAPP described treatment of water samples with AOP technologies. The toxicity of treated water may be assessed using a nitrification inhibition (NI) test. Additional toxicity testing using a Microtox® toxicity test will also be employed to indicate possible ecotoxicity of the treated water (post AOP treatment). The results from these tests will help EPA make decisions about how to treat and dispose of water contaminated with toxic chemicals.

It is anticipated that the QAPP developed for the previous work assignment (Contract number EP-C-11-006, Work Assignment 4-09) will be sufficient or can be modified with minimal effort. For costing purposes, the contractor shall assume that the level of effort is equivalent to evaluation of three AOP technologies with one contaminants in ~~one~~ three source of waters, and that NI tests will not need performed.

DELIVERABLE:

- Data to support development of papers described in Tasks 1, it is anticipated that all deliverables will be completed by ~~Jan. 31~~Sept 29, **2016**

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-10

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	To	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X	Option Period Number	Emerg. Cont. & Stable Isotopes

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	4.C, 4.E.1, and 4.E.2

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

Period of Performance: From 10/08/2015 To 09/29/2016

Comments:
The contractor shall immediately start work on all tasks listed in the Work Assignment Performance Work Statement.

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

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

SFO (Max 2): 27

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 (Max 7)
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Authorized Work Assignment Ceiling

Contract Period: To — 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 Marc Mills	(Signature)	(Date)	Branch/Mail Code:
			Phone Number 513-569-7322
			FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7196
			FAX Number:
Other Agency Official Name Ruth Corn	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7920
			FAX Number:
Contracting Official Name Candice Charlton	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-487-2007
			FAX Number:

PERFORMANCE WORK STATEMENT
CONTRACT NUMBER EP-C-15-010

WORK ASSIGNMENT NUMBER: 0-10

WORK ASSIGNMENT TITLE: EMERGING CONTAMINANTS AND STABLE ISOTOPES METHODS AND ANALYSES

PERIOD OF PERFORMANCE: CO Issuance through September 29, 2016

PROJECT SITE: U.S. EPA, AWBERC, 26 W. Martin Luther King Dr., Cincinnati, OH 45268

U.S. EPA Work Assignment Contracting Officer's Representative (WACOR): Marc Mills, 513.569.7322
U.S. EPA Alternate WACOR: Carolyn Acheson, 513.569.7190

INTRODUCTION

In the past, risk management research was often initiated after health effects and exposure research had characterized the impact and extent of a contaminant problem. Today, risk management research is occurring concurrent with other exposure and effects research in the risk paradigm. As a result, risk management research is addressing emerging contaminants along with persistent legacy contaminants. In some cases, research will require the development of analytical methods to characterize environmental sources of contaminants as well as characterizing treatment performance of current risk management techniques and developing improved treatment techniques when current techniques are insufficient.

In the Land Remediation and Pollution Control Division (LRPCD) of U.S. EPA's National Risk Management Research Laboratory (NRMRL), research on contaminants is focused in three areas: emerging contaminants (ECs), per- and poly-fluorinated compounds (PFCs), and stable isotopes (C, N, O, and H) to characterize sources of water (precipitation, ground water, surface water, etc.), sources of carbon and nitrogen, and contaminant movement in food webs, solids (soils, sediments, biosolids, sludges, and tissues).

Activities on this Work Assignment (WA) will develop analytical methods for emerging contaminants and stable isotopes and will use these methods to evaluate environmental samples and characterize treatment in environmental matrices and related risk management and treatment systems.

TASKS

Activities in this WA will occur in four tasks:

Task 1 - Developing Methods for ECs
Task 2 - Developing Methods for PFCs
Task 3 - Develop Methods for Stable Isotopes

Task 4 - ECs, PFCs, and Stable Isotope Analysis on Environmental Samples to Support Research

Explanations of the requirements and deliverables for each task follow.

Equipment for this WA provided by U.S. EPA includes chemical fume hoods, GC-MSs, LC-MSs, stable isotope mass spectrometers, automated extractors, shakers, constant temperature boxes, centrifuges, weighing balances, drying ovens, stir plates, reactors, various types of extraction equipment, and other equipment as necessary. In some cases, the Contractor may purchase consumable laboratory supplies. The primary locations for this work will be EPA/ORD AWBERC in Cincinnati and the Region 5 CRL in Chicago.

This research shall be conducted according to NRMRL and Region 5 CRL safety and health procedures, the NRMRL/LRPCD and Region 5 CRL Quality Assurance System, and other LRPCD procedures such as LRPCD Standard Operating Procedures (SOPs) and the LRPCD publication policy. Because this work assignment involves the use of Drug Enforcement Agency (DEA) regulated materials, Contractor personnel may be asked to provide information to conform with DEA paperwork requirements and will be required to follow Cincinnati Safety, Health and Environmental Management procedures for controlled substances.

Task 1 - Developing Methods for ECs

Task 1A - Review Project Background

The Contractor shall review applications of analytical chemistry methods, including but not limited to liquid chromatography mass spectrometry (LC-MS), GC-MS, HPLC, spectrophotometry, etc., for analytical support for environmental research of endocrine disrupting chemicals (EDCs) and other emerging contaminants. LRPCD requires quantitative methods for these analytes in the following matrices: ground waters, surface waters, wastewater (WW) influent, WW effluent, WW primary sludge, WW waste-activated sludge, treated sludge, soils, and sediments. Different matrices require different analytical approaches for analysis. These approaches can include extraction techniques (i.e., solvent extraction, solid phase extraction), cleanup or purification techniques (i.e., SPE cleanup, HPLC fractionation) and preparation (i.e., derivatization, enzymatic, or chemical reactions). The Contractor shall review relevant approaches to facilitate development of analytical plans for research.

The Contractor review should include a quarterly summary of the literature available on the analyses of these compounds in the matrices listed above. The summary shall be in the form of 5-10 pages of written, referenced text to be submitted electronically to the WACOR at the end of each quarter (i.e., December, March, June, and September). MS Word and Endnote shall be used for preparing and submitting all summaries and literature databases.

The analytes of interest in this task include steroid hormones such as estrogrens (i.e., estrone, 17-β-estradiol, 17-α-ethynylestradiol, estriol), androgens (i.e., testosterone, androstenedione, dihydrotestosterone, trenbolone), progesterones, and consumer chemicals (i.e., nonylphenol,

octylphenol, bisphenol A, nonylphenol monoethoxylate, nonylphenol diethoxylate, nonylphenol triethoxylate, the upper ethoxylates (NP4EO-NP20-EO, and OP4EO-OP20EO), and the alkylphenol carboxylic acids). Additionally, ECs such as pharmaceutical and personal care-product-related chemicals will be evaluated and may be integrated into the analytical methods based on occurrence, literature review, and expert consultation. Environmental samples may include ground water; surface waste; or municipal wastewater treatment influent, effluent, and solid residuals. A target analyte list will be provided to the Contractor upon award and are based on existing draft SOPs that are currently under development.

***Task 1B* - Prepare/Update Health and Safety Plan (HASP)**

The Contractor shall conduct this research according to NRMRL safety and health procedures. In most cases, samples prepared for analysis will be handled according to a safety plan prepared for the specific project. The samples may include PAHs, PCBs, EDCs, fluorinated chemicals, and other petrochemical contaminants. The media may include gases, liquids, and solid materials such as biosolids, manures, tissues, and soils. Some samples may originate in wastewater treatment plants or Confined Animal Feeding Operations (CAFOs) and have the potential for containing pathogenic microorganisms.

A HASP for working with materials contaminated with steroid hormones, Bisphenol A, and alkyl phenol ethoxylates, including sewage, and performing the chemical analyses described above was previously prepared and endorsed by SHEM and will be provided by the WACOR. The Contractor shall read the HASP and conduct activities under this PWS in a manner consistent with the HASP.

After reading the HASP, the Contractor may notice omissions or discrepancies between the HASP and laboratory practices; lab procedures may have evolved beyond the scope of the earlier HASP. In such a case, the Contractor may recommend a HASP revision. The WACOR will decide if revision is required and, if necessary, an amendment to the Work Assignment will be issued by the Contracting Officer.

Completion of this task shall be demonstrated by signing a document explaining that the HASP was read and understood and will be followed by Contractor staff.

***Task 1C* - Prepare Quality Assurance Project Plan (QAPP)**

QAPP L15095 (Demonstration of Performance of a Method to Analyze Samples for Steroid Hormones using Liquid Chromatography/Tandem Electrospray Mass Spectrometry) has been approved for this research. A copy is available from the WACOR. The Contractor shall read and follow the QAPP. The Contractor shall document deviations from the QAPP.

If a revision or addendum of the approved QAPP is needed, the Contractor shall prepare a draft modification at the WACOR's request via written technical direction. The Contractor shall revise the QAPP to reflect current LRPCD format, testing methods, controls, sampling locations, and other test chemicals. LRPCD QAPP templates in the current QAPP format will be provided

by the WACOR or the LRPCD QA manager. It should be noted that QAPP revisions are not accepted until the LRPCD QA review and approval process is complete. The draft may also be reviewed by the WACOR and other EPA staff. Based on input from the Quality Assurance Manager (QAM) and the WACOR, the Contractor shall revise the QAPP with 2 weeks of receiving written input. Once the QAM has endorsed and the WACOR has approved the revised QAPP, experiments may proceed under this QAPP.

Following completion of the experiments outlined in the QAPP, a data package shall be prepared by the Contractor describing the experiments. The experiment descriptions shall consist of a short description of materials and methods, summary of notable observations, and a copy of all data collected. Any deviations from the QAPP shall be noted. Data shall be presented in tabular and graphical forms. Two copies of the data package shall be delivered to the EPA WACOR 4 weeks after the completion of the QAPP experiments. The data package shall be delivered as a hard copy and a collection of electronic files. The electronic data package shall include the raw data files and the processed data files. The WACOR will review the data package and may request a revision if information is missing or unclear.

After the data report has been accepted by the WACOR, and based on the results from this research, the Contractor shall prepare SOPs for analyzing samples for specified analytes that reflect current laboratory methods within 4 weeks. Two SOPs are anticipated, one describing analysis of liquid samples, and one that describes analysis of solid samples. Currently, a draft SOP has been reviewed by the LRPCD QAM. Once the reviews have been addressed, the WACOR will submit them for review through the NRMRL process. The Contractor shall prepare these SOPs using the current NRMRL format. The NRMRL SOP template is available on the NRMRL QA web page or may be obtained from the WACOR or the LRPCD QAM. The WACOR will submit the SOPs to the LRPCD QAM. Based on input from the QAM and WACOR, the Contractor shall revise the SOPs within 2 weeks of receiving written input. After the revised SOPs have been endorsed as NRMRL SOPs and approved by the WACOR, the Contractor shall analyze samples in a manner that is consistent with the NRMRL SOPs.

Task 1D - Maintain Analytical Equipment

The Contractor shall conduct routine maintenance and support to keep the instruments in operation, including cleaning, source and interface maintenance, vacuum pump maintenance, and data file archiving. The equipment to be maintained will be specified by the WACOR via written technical direction. These activities shall include maintaining adequate log books and records per the SOP for Laboratory Notebooks. A maintenance schedule shall be developed for all analytical instrumentation used in this WA. This schedule shall be adjusted as needed to accommodate sample analysis or other WA tasks. The maintenance schedule shall be provided to the WACOR. The WACOR may attend maintenance activities at his discretion or the Contractor's request.

The Contractor shall participate in meetings with the WACOR to provide information concerning the progress of laboratory activities, notify the WACOR of problems, and review results. If appropriate, other EPA staff may attend these meetings at the request of the WACOR.

For example, the QAM may attend a meeting to discuss or review a QAPP. These meetings will occur at AWBERC. Informational meetings will occur about twice per month and last about 2 hours each. Summaries of these meetings will be made available to document discussions.

In some cases, the Contractor may purchase laboratory supplies, as needed, with approval from the WACOR/PO.

Task 2 - Developing Methods for PFCs

Task 2A - Review Project Background

The Contractor shall review applications of gas chromatography mass spectrometry (GC-MS) analysis and liquid chromatography mass spectrometry (LC-MS) analysis for environmental research of PFCs. LRPCD requires quantitative methods for these analytes in the following matrices: ground waters, surface waters, wastewater (WW) influent, WW effluent, WW primary sludge, WW waste-activated sludge, treated sludge, soils, and sediments. Different matrices require different analytical approaches for MS analysis. These approaches can include extraction techniques (i.e., solvent extraction, solid phase extraction), cleanup or purification techniques (i.e., SPE cleanup, HPLC fractionation) and preparation (i.e., derivatization, enzymatic, or chemical reactions). A review of relevant approaches is needed to facilitate development of analytical plans for research.

This review should include a quarterly summary of the literature available on the analyses of these compounds in the matrices listed above. The summary shall be in the form of 5-10 pages of written, referenced text to be submitted electronically to the WACOR at the end of each quarter (i.e., December, March, June, and September). The Contractor shall use MS Word and Endnote for preparing and submitting all summaries and literature databases.

Environmental samples may include ground water; surface waste; or municipal wastewater treatment plant influent, effluent, and solid residuals.

Task 2B - Prepare/Update Health and Safety Plan (HASP)

The Contractor shall conduct research according to NRMRL safety and health procedures. In most cases samples prepared for analysis will be handled according to a safety plan prepared for the specific project. The samples may include polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), EDCs, fluorinated chemicals, and other petrochemical contaminants. The media may include gases, liquids, and solid materials such as biosolids, manures, tissues, and soils. Some samples may originate in wastewater treatment plants or Confined Animal Feeding Operations (CAFOs) and have the potential for containing pathogenic microorganisms.

A HASP for working with materials contaminated with perfluorinated chemicals, EDCs, Bisphenol A, and alkyl phenol ethoxylates, including sewage, and performing the chemical analyses described above was prepared in a previous contract and endorsed by SHEM and will

be provided by the WACOR. The Contractor shall read the HASP and conduct activities under this PWS in a manner consistent with the HASP.

After reading the HASP, the Contractor may notice omissions or discrepancies between the HASP and laboratory practices or that laboratory procedures may have evolved beyond the scope of the earlier HASP. In such a case, the Contractor may recommend a HASP revision. The WACOR will decide if revision is required and, if necessary, an amendment to the Work Assignment will be issued by the Contracting Officer.

Completion of this task shall be demonstrated by signing a document explaining that the HASP was read and understood and will be followed by Contractor staff.

Task 2C - Prepare Quality Assurance Project Plan (QAPP)

QAPP 17808 (Demonstration of Method Performance for Extraction and Analysis of Perfluorinated Chemicals and Their Precursors in Complex Environmental and Biological Matrices) has been approved for this research. A copy is available from the WACOR. The Contractor shall read and follow the QAPP. The Contractor shall document deviations from the QAPP.

If a revision or addendum of the approved QAPP is needed, the Contractor shall prepare a draft modification at the WACOR's request via written technical direction. The Contractor shall revise the QAPP to reflect current LRPCD format, testing methods, controls, sampling locations, and other test chemicals. LRPCD QAPP templates in the current QAPP format will be provided by the WACOR or the LRPCD QA manager. It should be noted that QAPP revisions are not accepted until the LRPCD QA review and approval process is complete. The draft may also be reviewed by the WACOR and other EPA staff. Based on input from the QAM and WACOR, the Contractor shall revise the QAPP within 2 weeks of receiving written input. Once the QAM has endorsed and the WACOR has approved the revised QAPP, experiments may proceed under this QAPP.

Following completion of the experiments outlined in the QAPP, the Contractor shall prepare a data package describing the experiments. The experiment descriptions shall consist of a short description of materials and methods, summary of notable observations, and a copy of all data collected. Any deviations from the QAPP shall be noted. Data shall be presented in tabular and graphical forms. Two copies of the data package shall be delivered to the EPA WACOR 4 weeks after the completion of the QAPP experiments. The data package shall be delivered as a hard copy and a collection of electronic files. The electronic data package shall include the raw data files as well as the processed data files. The WACOR will review the data package and may request a revision if information is missing or unclear.

After the data report has been accepted by the WACOR, and based on the results from this research, the Contractor shall prepare the above SOPs for analyzing samples for specified analytes that reflects current laboratory methods within 4 weeks. Two SOPs are anticipated, one describing analysis of liquid samples and a second that describes analysis of solid samples. The

Contractor shall prepare these SOPs using the current NRMRL format. The NRMRL SOP template is available on the NRMRL QA web page or may be obtained from the WACOR or LRPCD QAM. The WACOR will submit the SOPs to the LRPCD QAM. Based on input from the QAM and the WACOR, the Contractor shall revise the SOPs with 2 weeks of receiving written input. Once the reviews have been addressed, the WACOR will submit them for review through the NRMRL process. After the revised SOPs have been endorsed as NRMRL SOPs and approved by the WACOR, the Contractor shall analyze samples in a manner that is consistent with the NRMRL SOPs.

***Task 2D* - Maintain Analytical Equipment**

The Contractor shall conduct routine maintenance and support to keep the instruments in operation, including cleaning, source and interface maintenance, vacuum pump maintenance, and data file archiving. The equipment to be maintained will be specified by the WACOR by written technical direction. These activities shall include maintaining adequate log books and records per the SOP for Laboratory Notebooks. The Contractor shall develop a maintenance schedule for all analytical instrumentation used in this WA. This schedule shall be adjusted as needed to accommodate sample analysis or other WA tasks. The maintenance schedule shall be provided to the WACOR. The WACOR may attend maintenance activities at his discretion or the Contractor's request.

The Contractor shall participate in meetings with the WACOR to provide information concerning the progress of laboratory activities, notify the WACOR of problems, and review results. If appropriate, other EPA staff may attend these meetings at the request of the WACOR. For example, the QAM may attend a meeting to discuss review of a QAPP. These meetings will occur at AWBERC. Informational meetings will occur about twice per month and last about 2 hours each. Summaries of meetings will be available to document discussions.

In some cases, the Contractor may purchase laboratory supplies, as needed, with approval from the WACOR/PO.

Task 3 - Develop Methods for Stable Isotopes

***Task 3A* - Review Project Background**

The Contractor shall review applications of stable isotope chemistry methods, including but not limited to direct, continuous flow, compound specific, etc., for analytical support for environmental research of stable isotopes in environmental matrices. LRPCD requires quantitative methods for these analytes in the following matrices: ground waters, surface waters, wastewater (WW) influent, WW effluent, WW primary sludge, WW waste-activated sludge, treated sludge, soils, tissues, and sediments. Different matrices require different analytical approaches for analysis. These approaches can include extraction techniques (i.e., solvent extraction, solid phase extraction), cleanup or purification techniques (i.e., SPE cleanup, HPLC fractionation) and preparation (i.e. fixing, biological or chemical reactions). The Contractor shall review applications of stable isotope ratio mass spectrometry (IRMS) analysis for environmental

research. Stable carbon and nitrogen isotopes can be used in a variety of applications for environmental research. The most common use for IRMS is source identification and tracking to identify sources and movement of specific pollutants. Another application for IRMS is in understanding of metabolic processes in the environment. An example of this work would be analysis of carbon flow through a food web. Different sample media require different analytical approaches for stable isotope analysis. A review of relevant approaches is needed to facilitate development of analytical plans for research.

Task 3B* - *Update Health and Safety Plan (HASP)

The Contractor shall conduct research according to NRMRL safety and health procedures. In most cases, samples prepared for analysis by IRMS will be handled according to a safety plan prepared for the specific project. The samples may include PAHs, PCBs, EDCs, and other petrochemical contaminants. The media may include gases, liquids, and solid materials such as biosolids, manures, and soils. Some samples may originate in wastewater treatment plants or Confined Animal Feeding Operations (CAFOs) and have the potential for containing pathogenic microorganisms. The HASP shall be reviewed and updated as applicable. The Safety Office and WACOR will review the HASP and schedule a meeting to review any revisions with the Contractor. Comments shall be addressed and incorporated as applicable within 2 weeks. The final HASP shall be submitted to the WACOR and Safety Office. The Contractor will be given a copy of the final HASP.

Task 3C* - *Prepare/Update Quality Assurance Project Plan (QAPP)

The Contractor shall develop a new Category III Quality Assurance Plan in accordance with U.S. EPA/LRPCD guidelines available at http://intranet.epa.gov/nrmintra/lsas/eqmp/index.html. The plan shall address sample preparation and analysis by IRMS from a sample medium basis rather than a project basis. Gas, liquid, and solid samples will most likely be handled in consistent ways regardless of individual projects. The WACOR will notify the Contractor via written technical direction if the samples shall be handled differently. Each medium will need a specific sample preparation and analysis plan to address handling, analysis, and quality control procedures. The overriding factor in isotope analysis is sample handling consistency.

Task 3D* - *Work/Experimental Requirements

The Contractor shall provide both direct support for LRPCD research and other ORD research supported by LRPCD. The WACOR shall designate to the Contractor whether sample analysis supports LRPCD or ORD, and the Contractor shall track their costs in two categories as either LRPCD or ORD (or similar designation).

Guidance for development of SOPs is available at http://www.epa.gov/quality/qs-docs/g6-final.pdf.

The Contractor shall prepare a new QAPP draft for developing SOPs for the stable isotope methods at the WACOR's request via written technical direction. The Contractor shall provide a

draft QAPP to reflect current LRPCD format, testing methods, controls, sampling locations, and other test chemicals. LRPCD QAPP templates in the current QAPP format will be provided by the WACOR or the LRPCD QAM. It should be noted that QAPP revisions are not accepted until the LRPCD QA review and approval process is complete. The draft may also be reviewed by the WACOR and other EPA staff. Based on written input from the QAM and WACOR, the Contractor shall revise the QAPP within 2 weeks of receiving said input. Once the QAM has endorsed and the WACOR has approved the revised QAPP, experiments may proceed under this QAPP to develop SOPs for the matrices listed below.

Following completion of the experiments outlined in the QAPP, the Contractor shall prepare a data package describing the experiments. The data package shall consist of a short description of materials and methods, summary of notable observations, and a copy of all data collected. Any deviations from the QAPP shall be noted. Data shall be presented in tabular and graphical forms. Two copies of the data package shall be delivered to the EPA WACOR 4 weeks after the completion of the QAPP experiments. The data package shall be delivered as a hard copy and a collection of electronic files. The electronic data package shall include the raw data files as well as the processed data files. The WACOR will review the data package and may request a revision if information is missing or unclear.

After the data report has been accepted by the WACOR, and based on the results from this research, the Contractor shall prepare SOPs for analyzing samples for specified analytes that reflect current laboratory methods within 4 weeks. Multiple draft SOPs are anticipated for the analysis of gases, liquids, and solids. The Contractor shall prepare SOPs using the current NRMRL format. All SOPs shall include sample preparation and analysis. The NRMRL SOP template is available on the NRMRL QA web page or may be obtained from the WACOR or LRPCD QA manager. The WACOR will submit the SOPs to the LRPCD QAM. Based on written input from the QAM and the WACOR, the Contractor shall revise the SOPs with 2 weeks of receiving said input. Once the reviews have been addressed, the WACOR will submit them for review through the NRMRL process. After the revised SOPs have been endorsed as NRMRL SOPs and approved by the WACOR, the Contractor shall analyze samples in a manner that is consistent with the NRMRL SOPs.

The Contractor shall develop SOPs for specific matrices using specific stable isotope methods upon technical direction from the WACOR. It is anticipated that the following SOPs will be developed, but is not limited to, the following:

(i) SOPs to address analysis of solid samples (soils, sediments, sludges) using the Elemental Analyzer as input to the IRMS. The elements of interest are stable isotopes of carbon, nitrogen, oxygen, and hydrogen.

(ii) SOPs to address analysis of liquid samples (aqueous, non-aqueous extracts) using the elemental analyzer as input to the IRMS.

(iii) SOPs to address analysis of gas phase samples using the GC instrument as the input to the IRMS. The initial analytes of interest will be simple gas compounds including but not limited to CO_2, CH_4, N_2, NH_3, NO_x, and other simple molecules.

(iv) SOPs for the analysis of complex mixtures of analytes using the GC as input to the IRMS in a compound specific IRMS mode. The typical analytes include, but are not limited to PCBs, petroleum fractions solvents, and other complex mixtures.

(v) SOPs to analyze tissue samples for the C, N, and H isotopes.

(vi) SOPs to analyze water samples for C, N, O, and H stable isotopes

Task 3E - Maintain Analytical Equipment

The Contractor shall conduct routine maintenance and support activities to keep the instruments in operation, including cleaning, source and interface maintenance, vacuum pump maintenance, and data file archiving. The equipment to be maintained will be specified by the WACOR by written technical direction. These activities shall include maintaining adequate log books and records per the SOP for Laboratory Notebooks. The Contractor shall develop a maintenance schedule for all analytical instrumentation used in this WA. This schedule shall be adjusted as needed to accommodate sample analysis or other WA tasks. The maintenance schedule shall be provided to the WACOR. The WACOR may attend maintenance activities at his discretion or the Contractor's request.

The Contractor shall participate in meetings with the WACOR to provide information concerning the progress of laboratory activities, notify the WACOR of problems, and review results. If appropriate, other EPA staff may attend these meetings at the request of the WACOR. For example, the QAM may attend a meeting to discuss and/or review a QAPP. These meetings will occur at AWBERC. Informational meetings will occur about twice per month and last about 2 hours each. Summaries of meetings will be available to document discussions.

In some cases, the Contractor may purchase laboratory supplies, as needed, with approval from the WACOR/PO.

Task 4 - ECs, PFCs, and Stable Isotope Analysis on Environmental Samples to Support Research

Task 4A - Demonstrate Knowledge and Proficiency with Environmental Chemical Analysis Methods for ECs, PFCs, and Stable Isotopes

The Contractor shall familiarize themselves with several documents:

- Health and Safety Plan (HASP, available from WACOR)
- Sample inventories
- Methods for analyzing aqueous samples for steroid hormones and biosolids samples

In some cases, these documents may be updated during this WA period of performance. In other cases, current versions are acceptable as is. The WACOR will provide written direction if modifications are required. It is important that the Contractor become familiar with these documents so that research can be conducted in a safe and consistent manner with attention to data quality.

The Contractor shall conduct research according to NRMRL safety and health procedures. In most cases, samples prepared for analysis shall be handled according to a safety plan prepared for the specific project. The samples may include PAHs, PCBs, EDCs, fluorinated chemicals, and other petrochemical contaminants. The media may include gases, liquids, and solid materials such as biosolids, manures, tissues, and soils. Some samples may originate in wastewater treatment plants or Confined Animal Feeding Operations (CAFOs) and have the potential for containing pathogenic microorganisms.

A HASP for working with materials contaminated with perfluorinated chemicals, EDCs, Bisphenol A, and alkyl phenol ethoxylates, including sewage, and performing the chemical analyses described above was prepared in a previous contract and endorsed by SHEM and will be provided by the WACOR. The Contractor shall read the HASP and conduct activities under this PWS in a manner consistent with the HASP.

After reading the HASP, the Contractor may notice omissions or discrepancies between the HASP and laboratory practices or that laboratory procedures may have evolved beyond the scope of the earlier HASP. In such a case, the Contractor may recommend a HASP revision. The WACOR will decide if revision is required and, if necessary, an amendment to the Work Assignment will be issued by the Contracting Officer.

Completion of this task shall be demonstrated by signing a document explaining that the HASP was read and understood and will be followed by Contractor staff.

***Task 4B* - Analyze Samples for ECs, PFCs, and Stable Isotopes**

The Contractor shall analyze up to 400 samples for ECs and PFCs and 2,000 samples for SIA using NRMRL SOPs that will either be provided to the Contractor by the WACOR or developed as part of this WA. These samples are from numerous studies on the transport and fate of ECs and EDCs being jointly conducted by U.S. EPA and various other field and laboratory projects. The samples will consist of influent, effluent, and biosolids from municipal wastewater treatment plants (WWTPs), mixed municipal/industrial WWTPs, on-site WWT units, receiving waters, CAFO impacted samples, sediments, and surface waters. Samples may be processed in Cincinnati AWBERC facilities or the Region 5 CRL in Chicago. The SOPs will provide a quality assurance framework for samples analysis. The Contractor shall not be responsible for quality assurance associated with samples collection, transport, or data interpretation of results associated with these various projects. In some cases, the Contractor shall be responsible for receiving samples and subsampling, preserving, packaging, and either developing or transferring a Chain-of-Custody (COC) for these samples to other laboratories. The EPA WACOR shall be responsible for arranging with outside laboratories for the receipt of these samples and providing

shipping approval.

The Contractor will be notified in advance of the number of samples, sample types, sampling dates, and the expected date of receipt by the WACOR and will be provided with a brief description of the samples including potential hazards. As needed, the WACOR will provide the Contractor with the HASP associated with sample collection. The Contractor shall be responsible for receiving these samples and maintaining the COC. The Contractor shall notify the WACOR of sample receipt and provide copies of the complete COC forms for each sample.

If SOP data quality objectives (DQOs) are not met for samples, the WACOR and the Federal staff submitting the samples shall be notified as soon as possible. This early notification permits the reanalysis of samples at the WACOR's discretion. The WACOR and the Contractor staff may meet or communicate to resolve issues on samples not meeting DQOs.

Following completion of sample analysis, a data package shall be prepared by the Contractor consisting of a short description of materials and methods, listing the QAPP describing analytical methods, which will be either a) QAPP L15095 (Demonstration of Performance of a Method to Analyze Samples for Steroid Hormones using Liquid Chromatography/Tandem Electrospray Mass Spectrometry, Approved 1/24/2012), b) QAPP 17808 (Demonstration of Method Performance for Extraction and Analysis of Perfluorinated Chemicals and Their Precursors in Complex Environmental and Biological Matrices, Approved 8/1/2013), or c) new QAPPs to be developed under this WA or other research projects, a summary of notable observations including compliance with data quality objectives, and a copy of all data collected. Any deviations from the QAPP shall be noted. Data shall be presented in tabular and graphical forms. Two copies of the data package shall be delivered to the EPA WACOR 4 weeks after the receipt of each sample. The data package shall be delivered as a hard copy and a collection of electronic files. The electronic data package shall include the raw data files and the processed data files. The WACOR will review the data package and may request a revision if information is missing or unclear. In some cases, data packages will describe multiple samples analyzed in that group. The WACOR will specify samples to be included in these larger data packages.

Task 4C - Maintain Electronic Database of Samples Analyzed

The Contractor shall be responsible for maintaining an electronic database of all samples analyzed under this WA (GC-MS methods and LC-MS methods). This database will be accessible to all of the Contractor staff working on the project, the WACOR, the Alternate WACOR, and those designated by the WACOR or Alternate WACOR. It is expected the database will be maintained in either MS Excel or MS Access; however, alternative formats will be considered by WACOR but require final approval before proceeding.

The database should be electronically searchable, provide easy data entry, and include all the analytical parameters included in the Agilent MS Chem data output plus sample specific parameters, such as sample location, date sampled, date extracted, data qualifiers, sample notes, etc. The WACOR shall be consulted before any database format will be utilized. The Contractor shall provide up to three viable database options within 6 weeks of the WA start date

and shall meet with the WACOR to review and decide on a database approach.

***Task 4D* - Maintain Analytical Equipment**

The Contractor shall conduct routine maintenance and support activities to keep the instruments in operation, including cleaning, source and interface maintenance, vacuum pump maintenance, and data file archiving. The equipment to be maintained will be specified by the WACOR via written technical direction. These activities shall include maintaining adequate log books and records per the EPA ORD PPM 13.2 "Paper Laboratory Records". A maintenance schedule shall be developed for all analytical instrumentation used in this WA. The Contractor shall adjust this schedule as needed to accommodate sample analysis or other WA tasks. The maintenance schedule shall be provided to the WACOR.

The Contractor shall participate in meetings with the WACOR to provide information concerning the progress of laboratory activities, notify the WACOR of problems, and review results. If appropriate, other EPA staff may attend these meetings at the request of the WACOR. For example, the QAM may attend a meeting to discuss review of a QAPP. These meetings will occur at AWBERC. Informational meetings will occur about twice per month and last about 2 hours each. The Contractor shall provide a summary of the meeting to document discussions.

In some cases, the Contractor may purchase laboratory supplies, as needed, with approval from the WACOR/PO.

QUALITY ASSURANCE

All research activities which generate data must follow the guidance of ORD Policy and Procedures Manual Section 13.4, *Minimum QA\QC Practices for ORD Laboratories Conducting Research*: PPM 13.4 Training.

Research records shall follow the applicable policy for laboratory notebooks, according to ORD Policy and Procedure Manual Section 13.2, *Paper Laboratory Records*: PPM 13.2 Training. Copies of the current Quality Assurance policies may be obtained here: Chapter 13 Policy and Procedures Manual.

When applicable, the Contractor shall follow SOPs published by LRPCD at http://intranet.ord.epa.gov/p2/nrmrl/standard-operating-procedures-technical-lrpcd. As SOPs are revised and new SOPs are published, the list of approved SOPs changes. Therefore, it is important that SOPs published at this web location be consulted when referencing LRPCD SOPs.

The tasks and subtasks in this contract action identify QAPPs that will or may require revision. QAPP revisions must be reviewed and approved by the LRPCD QAM before research under this work assignmentmay begin.

PROGRESS MEETINGS

Meetings will be held with the WACOR bimonthly or more often if needed. Additional personnel may attend as requested by the WACOR.

EXPECTED OUTPUTS

Individual project analytical data shall be tailored to the work assignment by the Contractor. In most cases, the expected data should take the form of electronic records in a format suitable for further data processing and synthesis. QA/QC data shall be included with each report. The Contractor shall prepare individual SOPs for analysis of analytes in different matrices.

COMMENTS

Area Where Work Performed: Primarily AWBERC Room/Laboratory: B4, B6, B8, 404-409, 420, 425, 432, 442, 517, 715, 720, 729

EPA-Provided Equipment: Five LC-MS instruments, four GC-MS instruments, three sets of automated extraction equipment, three IRMS instruments, two elemental analyzers and continuous flow devices, GC and continuous flow devices, H-device, and other related peripherals such as sample preparation equipment and auto-samplers.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-11

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	To	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X	Option Period Number	Water and community adaptation

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	4(B)-3, 4(C)-3, 4(G)

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

Period of Performance: From 01/15/2016 To 09/29/2016

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

	Cost/Fee:	LOE:
Contract Period: To		0
This Action:		0
Total:		0

Work Plan / Cost Estimate Approvals

	Cost/Fee	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name Jeff Yang	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-569-7655 FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-569-7196 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
Contract No. **EP-C-15-010**
WA 0-11

TITLE: Water and community adaptation methods and applications

Work Assignment Contracting Officer's Representative (WACOR):

Y. Jeffrey Yang
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U.S. EPA ORD/NRMRL
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PERIOD OF PERFORMANCE: CO Issuance through September 29, 2016

Background

The U.S Environmental Protection Agency (U.S. EPA) is implementing research that has been systematically planned and organized within its Research Action Plan (RAP) programs. One research theme is centered at climate change adaptation and community sustainability. In addition, EPA has a standing Regional Applied Research Effort (RARE) program to bring science expertise and effective environmental solutions to address high-priority regional needs. This project is a part of the EPA Water Resources Adaptation Program (WRAP) activities in support of the RAP and RARE research.

Specific research activities of this work assignment are described below. It should be noted that the activities below continue to build on those of WA 4-11 under EPC11006. With this continuity in mind, the Contractor may consider the previously approved work plan, and identify timelines and milestones to accomplish the task within this WA Period of Performance.

Project Description

Task 1 Preparedness Integration – Quantitative Risk Analysis

This task is to develop climate change adaptation methods and emergency preparedness for coastal communities facing the threat of disruptive storm surge, hurricanes and projected sea level rise. It will focus on the southeastern Massachusetts coast with a detailed case study in Mattapoisett and adjacent communities when appropriate (Figure 1). Through climate modeling and risk analysis of community infrastructures, the project research activities will produce technical methods and a process of engaging local communities in emergency preparedness. The research activities involve a wide range of science and technical disciplinary fields (See below).

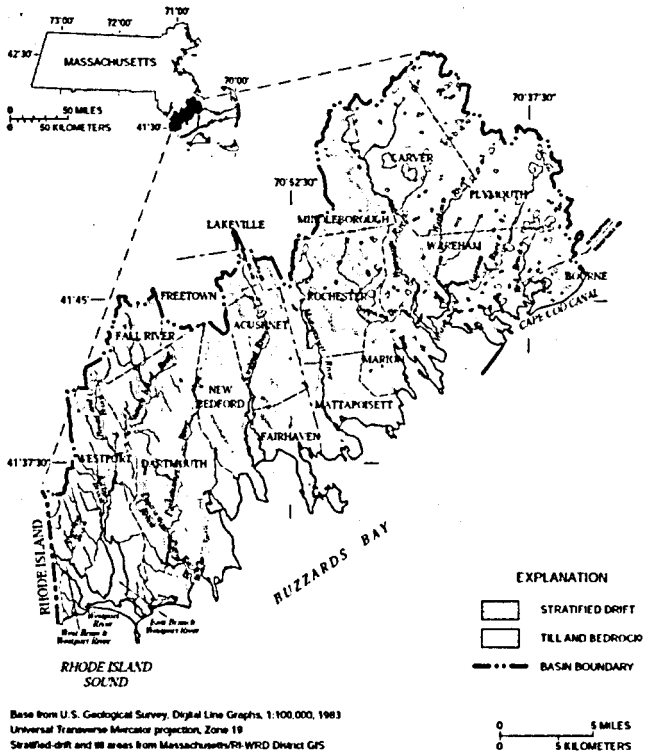

Figure 1. Locations of New Bedford/Fairhaven and Mattapoisett selected for the case studies. From USGS Report 95-4234.

For the Mattapoisett and adjacent Fairhaven/New Bedford region (Figure 1), an EPA research plan (available to the contractor) outlines a major technical approach and preliminary project coordination with local communities and state agencies. Several concurrent EPA research activities are ongoing. Some initial results shall be used in this project; for example, quantitative modeling has conducted in projection of inundation areas and wave propagation of disruptive storm surges under assumed degree of seal level rises (SLR). These new data and technical information are available from EPA for the contactor's use in conducting the analysis below.

The Contractor has analyzed technical approach for traffic analysis in hurricane evacuation under WA 4-11. For this WA, the contractor shall complete the transportation and power supply for the projected storm surge scenarios. Specifically the focus should be centered at:

- Traffic conditions and traffic management required for orderly and effective community evacuation, considering Mattapoisett and its neighboring communities of Fairhaven and New Bedford using the existing highways I-195 and Rt_6;
- Disruption to power supply and its effects on traffic and water management during the events.

In order to produce the results, the Contractor shall acquire necessary data and information for the analysis. The research results shall be provided to project team members in coordination with the EPA WACOR in Task 3 for community preparedness integration. For project outputs, the Contractor should use ArcGIS platform for outputs of the traffic analysis. The dataset and maps for Mattapoisett and other relevant communities shall be uploaded into EnviroAtlas for a community example. The datasets, GIS maps, model runs, and the template generated in the case study can be used to assess the other coastal communities in Region 1.

Task 2 Citizen science in hurricane impact analysis and preparedness awareness

The Contractor has worked with EPA project team under the EPC11006, WA 4-11 in organizing the citizen science and community participation in emergency preparedness. For this WA, the Contractor shall work with EPA team on the following three separate but related activities:

1) Data acquisition for relevant communities.

   The Contractor shall collect relevant physical information and community response plans, including all previous modeling exercises including but not limited to those that have been conducted through the Buzzards Bay National Estuary Program and the Climate Ready Estuary projects. The technical data and information shall be provided to the EPA WACOR and responsible personnel. The Contractor shall then distribute the data and information to project team working on Subtask 1b.

2) Conduct a citizen science exercise to study climate impacts through photo analysis, or through a climate listens event with citizens in the case study areas. The obtained historical records and data shall be provided to EPA WACOR and responsible personnel, and be used by project team members working on other tasks.

3) Conduct three public forums to effectively engage local communities in preparedness against storm surge impacts. The first forum will bring community and utility stakeholders together, identify valued assets, and identify emergency planning and response approaches; this forum will result in identifying performance measures and how success will be defined. Second community stakeholder forum will provide results from the climate and infrastructure analyses and the citizen science retrospective analysis. This will result in a dialogue about how best to integrate the analysis into the communities' planning. Final forum will target broader community engagement through visual presentation of the process, presentation of final results and celebration of completion.

Task 3 Emergency Plan Revision

Based on the results from above-mentioned two tasks, the Contractor shall assist the EPA project team under coordination from the EPA WACOR in evaluation and, if necessary, updating the existing community emergency plans. The revision will be required to address the likely current and future potential climate-related risks from storm surge, hurricanes, and projected sea level rise to water and transportation infrastructure loss, and ways to adapt and reduce the community cost.

Task 4 Project management

The Contractor shall, if necessary, make appropriate adjustment/revisions to the previously approved Quality Assurance Project Plan (QAPP) W-13620-EP-1-1 and amendments. For the overall EPA project coordination, the project schedules below should be followed.

1) By March 1, 2016, Task 1 shall be completed and the emergency traffic analysis results shall be submitted to the EPA WACOR in a GIS format.

2) Task 2 shall be completed with citizen science and data analyzed for submission to the EPA WACOR no later than May 15, 2016.

3) When necessary, the revision to local emergency preparedness plan will be conducted within 3 months after the conclusion of Task 1 and 2. It is anticipated that the Contractor will provide necessary personnel and technical support in the plan revision process.

4) Monthly report. The monthly report shall be completed and submitted to EPA per the relevant Contract clause.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-12

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	To	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X	Option Period Number	Analytical Support for WQMB

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	Section 4, Paragraphs B, C, E, H

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

Period of Performance: From 10/06/2015 To 09/29/2016

Comments:
The contractor shall immediately start work on all tasks listed in the Work Assignment Performance Work Statement.

☐ 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 (Max 7)
1										
2										
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Authorized Work Assignment Ceiling

Contract Period: To — 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 Donald Brown	(Signature)	(Date)	Branch/Mail Code:
			Phone Number 513-569-7630
			FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7196
			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

EPA Contract No.: EP-C-15-010
Work Assignment No.: 0-12

Title: Analytical Support to Water Quality Management Branch (WQMB)

Work Assignment Contracting Officer's Representative (WACOR):
Donald Brown
513-965-4805 (ESF)
brown.donald@epa.gov

Alternate WACOR:
Christopher Nietch
513-569-7460
nietch.christopher@epa.gov

Period of Performance: CO Issuance thru September 29, 2016

Location: AWBERC, Experimental Stream Facility, East Fork Watershed field sites

Goals: Provide analytical support to the Water Quality Management Branch (WQMB) using existing government-furnished instrumentation.

Outputs/Outcomes: Data generation and management from water, sediment, and biotic samples. This work will support Safe and Sustainable Water Research.

Background:
The National Risk Management Research Laboratory's WQMB has need for analytical services in laboratories located at AWBERC and the Experimental Stream Facility (ESF). EPA also needs assistance in the collection of samples at the ESF and the East Fork Watershed of the Little Miami River (EFWS). The WQMB needs experienced personnel to process and analyze samples including water, wastewater, plant, animal, and sediment samples.

Quality Assurance Project Plan (QAPP): All work will be performed in accordance with "Quality Management Plan And Baseline Quality Assurance Project Plan: Experimental Stream Facility And East Fork Watershed Study: Research Linking Land Use Management Practices To Ecologic Structure And Function In Small Stream Ecosystems" (QAPP) (2006) and yearly addendums; the Health and Safety Plan (HASP 2014-056) (2014); and ESF Standard Operating Procedures (SOP). All documents will be supplied by the EPA WACOR.

Tasks:
Task 1- Nutrient Analyses.

The contractor shall provide assistance with the analysis of approximately 400 aqueous samples per month using an automated wet chemistry analyzer (located on 6th floor of AWBERC) for nutrient species. (Routine lab work associated with the analyses, such as preparation of calibration standards, weighing samples, filtering samples, performing pre-analysis chemical digestions, and cleaning glassware will be performed by others.) Contractor personnel must have a basic knowledge of and experience with this type of instrument and use existing SOPs provided by the WACOR. Written technical direction will be provided by the WACOR as needed. The contractor shall provide technical assistance in interpreting instrumentation outputs to the WACOR, or an EPA scientist, as indicated in written technical direction from the WACOR. If the contractor determines that changes are needed in the QAPP or SOPs, they shall submit a revised QAPP or SOP to the EPA WACOR for review.

Task 2 – Aquatic Invertebrates.
The contractor shall assist in the sorting of aquatic invertebrates. There will be approximately 300 total samples, collected June – September. Technical direction will be provided by the EPA WACOR for sorting priorities.

Task 3 – Algae.
The contractor shall evaluate approximately 700 total samples per WA period of performance, for algae identification and enumeration with heavier sample loads coming in October, November and May – September.

Task 4- ESF Sampling.
The contractor shall assist with 10 – 12 sampling events at ESF, including preparation before the event and processing samples during the event. The EPA WACOR will provide a written technical directive to initiate support for a sampling event. Typical preparation work includes washing, labeling and organizing containers; and sieving, washing, drying and weighing gravel. Typical processing work includes: filtering, sieving, weighing, drying and ashing sediment and periphyton samples; and putting samples in appropriate containers for future analyses. Contractor personnel must have a basic knowledge of basic lab procedures such as using a filter manifold, analytical balance, drying oven and muffle furnace. The contractor shall use existing SOPs provided by the WACOR, but written technical direction will be provided by the WACOR as needed.

Task 5 – ESF Routine Tasks.
The contractor shall assist the EPA WACOR in all aspects of the day-to-day experimental work at the ESF, including set-up, performance, and tear-down of yearly experiments. Set-up includes preparing stream mesocosms for new experiments, with tasks such as sieving and washing gravel, weighing and installing gravel baskets and tiles, and installing fish and clam habitats. Performance includes conducting an experiment, with tasks such as labeling and organizing sampling containers, collecting and processing samples, and set-up and take-down of periodic sampling equipment such as drift nets and emergent traps. Tear-down includes decommissioning mesocosms at the end of the experiments, with tasks such as removing tiles gravel baskets, cleaning out

accumulated sediment and algae, and scrubbing empty stream beds. Specific work tasks shall be completed using ESF SOPs that will be provided by the EPA WACOR and technical direction from the EPA WACOR via email.

Task 6 – EFWS Sampling.
The contractor may be requested to provide assistance for up to 12 field sampling events per WA period of performance, as requested by technical directive from the EPA WACOR at least 2 working days prior to the sampling event. When requested, the contractor will assist EPA staff with flow measurements in streams and collection of water samples at both stream and lake locations within the EFWS.

Material and Supplies: The EPA will provide all materials and supplies required to perform the tasks described above. The contractor shall notify the EPA WACOR by email if any materials and supplies are needed to complete the tasks, with a minimum 2 week lead time.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-12

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-010

Contract Period: 09/30/2015 To 09/29/2016

Base X Option Period Number

Title of Work Assignment/SF Site Name: Analytical Support for WQMB

Contractor: PEGASUS TECHNICAL SERVICES, INC.

Specify Section and paragraph of Contract SOW: Section 4, Paragraphs B, C, E, H

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

Period of Performance: From 10/06/2015 To 09/29/2016

Comments:
Purpose: The purpose of this amendment is to add Task 7, all other tasks remain the same.

☐ 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: 09/30/2015 To 09/29/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Donald Brown
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-569-7630
FAX Number:

Project Officer Name: Michael Moeykens
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-569-7196
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

EPA Contract No.: EP-C-15-010
Work Assignment No.: 0-12
Amendment 1

Title: Analytical Support to Water Quality Management Branch (WQMB)

Work Assignment Contracting Officer's Representative (WACOR):
Donald Brown
513-965-4805 (ESF)
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Alternate WACOR:
Christopher Nietch
513-569-7460
nietch.christopher@epa.gov

Purpose: The purpose of this amendment is to add Task 7, all other tasks remain the same.

Period of Performance: CO Issuance thru September 29, 2016

Location: AWBERC, Experimental Stream Facility, East Fork Watershed field sites

Goals: Provide analytical support to the Water Quality Management Branch (WQMB) using existing government-furnished instrumentation.

Outputs/Outcomes: Data generation and management from water, sediment, and biotic samples. This work will support Safe and Sustainable Water Research.

Background:
The National Risk Management Research Laboratory's WQMB has need for analytical services in laboratories located at AWBERC and the Experimental Stream Facility (ESF). EPA also needs assistance in the collection of samples at the ESF and the East Fork Watershed of the Little Miami River (EFWS). The WQMB needs experienced personnel to process and analyze samples including water, wastewater, plant, animal, and sediment samples.

Quality Assurance Project Plan (QAPP): All work will be performed in accordance with "Quality Management Plan And Baseline Quality Assurance Project Plan: Experimental Stream Facility And East Fork Watershed Study: Research Linking Land Use Management Practices To Ecologic Structure And Function In Small Stream Ecosystems" (QAPP) (2006) and yearly addendums; the Health and Safety Plan (HASP 2014-056) (2014); and ESF Standard Operating Procedures (SOP). All documents will be supplied by the EPA WACOR.

Tasks:

Task 1- Nutrient Analyses.

The contractor shall provide assistance with the analysis of approximately 400 aqueous samples per month using an automated wet chemistry analyzer (located on 6th floor of AWBERC) for nutrient species. (Routine lab work associated with the analyses, such as preparation of calibration standards, weighing samples, filtering samples, performing pre-analysis chemical digestions, and cleaning glassware will be performed by others.) Contractor personnel must have a basic knowledge of and experience with this type of instrument and use existing SOPs provided by the WACOR. Written technical direction will be provided by the WACOR as needed. The contractor shall provide technical assistance in interpreting instrumentation outputs to the WACOR, or an EPA scientist, as indicated in written technical direction from the WACOR. If the contractor determines that changes are needed in the QAPP or SOPs, they shall submit a revised QAPP or SOP to the EPA WACOR for review.

Task 2 – Aquatic Invertebrates.

The contractor shall assist in the sorting of aquatic invertebrates. There will be approximately 300 total samples, collected June – September. Technical direction will be provided by the EPA WACOR for sorting priorities.

Task 3 – Algae.

The contractor shall evaluate approximately 700 total samples per WA period of performance, for algae identification and enumeration with heavier sample loads coming in October, November and May – September.

Task 4- ESF Sampling.

The contractor shall assist with 10 – 12 sampling events at ESF, including preparation before the event and processing samples during the event. The EPA WACOR will provide a written technical directive to initiate support for a sampling event. Typical preparation work includes washing, labeling and organizing containers; and sieving, washing, drying and weighing gravel. Typical processing work includes: filtering, sieving, weighing, drying and ashing sediment and periphyton samples; and putting samples in appropriate containers for future analyses. Contractor personnel must have a basic knowledge of basic lab procedures such as using a filter manifold, analytical balance, drying oven and muffle furnace. The contractor shall use existing SOPs provided by the WACOR, but written technical direction will be provided by the WACOR as needed.

Task 5 – ESF Routine Tasks.

The contractor shall assist the EPA WACOR in all aspects of the day-to-day experimental work at the ESF, including set-up, performance, and tear-down of yearly experiments. Set-up includes preparing stream mesocosms for new experiments, with tasks such as sieving and washing gravel, weighing and installing gravel baskets and tiles, and installing fish and clam habitats. Performance includes conducting an experiment, with tasks such as labeling and organizing sampling containers, collecting and processing samples, and set-up and take-down of periodic sampling equipment such

as drift nets and emergent traps. Tear-down includes decommissioning mesocosms at the end of the experiments, with tasks such as removing tiles gravel baskets, cleaning out accumulated sediment and algae, and scrubbing empty stream beds. Specific work tasks shall be completed using ESF SOPs that will be provided by the EPA WACOR and technical direction from the EPA WACOR via email.

Task 6 – EFWS Sampling.
The contractor may be requested to provide assistance for up to 12 field sampling events per WA period of performance, as requested by technical directive from the EPA WACOR at least 2 working days prior to the sampling event. When requested, the contractor will assist EPA staff with flow measurements in streams and collection of water samples at both stream and lake locations within the EFWS.

Task 7 – Periphyton Sampling in EFWS.
The contractor shall assist in the collection of periphyton samples from 25 sites within the EFWS, as requested by technical directive from the EPA WACOR. Sites are to be sampled weekly from June through September. Sample visits will include collection of periphyton from rocks along with water samples for other analyses and water samples for environmental DNA (eDNA) analysis (summary for each week: 25 periphyton samples, 25 water samples for chemical analysis, 25 water samples for eDNA). The contractor will also assist in the collection of data on physical characteristics of the sites, such as canopy cover/light intensity and cobble type. Over this sampling period Hester-Dendy samplers would be deployed during mid-summer (late July) and collected after 6 weeks of deployment (late August/early September). During the deployment of the Hester-Dendys, the contractor shall deploy five data sondes to collect dissolved oxygen information. The sondes should be rotated during the deployment of the Hester-Dendys such that 1 week of data is collected at each sampling site.

Material and Supplies: The EPA will provide all materials and supplies required to perform the tasks described above, except for Task 7 where the contractor will need to obtain sampling bottles and provide data sondes. The contractor shall notify the EPA WACOR by email if any materials and supplies are needed to complete the tasks, with a minimum 2 week lead time.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-14

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X To Option Period Number	Concentrating NOM from Water

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	4.C

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

Period of Performance: From 09/30/2015 To 09/29/2016

Comments:
The contractor shall immediately start work on all tasks listed in the Work Assignment Performance Work Statement.

☐ 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 (Max 7)
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Authorized Work Assignment Ceiling

Contract Period: To — 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 Pressman	(Signature)	(Date)	Branch/Mail Code: Phone Number 513-569-7625 FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-569-7196 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, Contract No. EP-C-15-010, Work Assignment No. 0-14

Concentrating Natural Organic Matter from Water Matrices

Work Assignment Manager (WAM):	**Jonathan G. Pressman**	**513-569-7625**
Alternate WAM	**Michael Moeykens**	**513-569-7196**
Period of Performance:	**9/30/15 through 9/29/16**	

Site: On-Site

INTRODUCTION

This research program focuses on concentrating natural organic matter (NOM) from drinking waters. After concentration, sulfate will be removed from the concentrate, and the product will be freeze dried for storage and subsequent use. The overall goal is to conduct scientific studies addressing the following objectives: (1) to determine the optimal operational conditions for the concentration of NOM from drinking waters as determined by minimizing NOM losses; (2) to determine the optimal operational conditions for removing sulfate from the concentrate; (3) to determine the optimal operational conditions for freeze drying the concentrate; (4) to operate the concentration equipment to produce concentrated and freeze dried NOM when needed for subsequent experiments; (5) to evaluate the adsorption of NOM and volatile organic chemicals (VOCs) on granular activated carbon (GAC) using several water matrices and reconstituted NOM solutions to develop a standardized NOM for benchmarking water treatment process improvements; and (6) to determine the optimal water chemistry conditions for chloraminating high concentration NOM solutions under conditions that simulate natural waters.

To achieve the objectives, an existing concentration system will be provided by the EPA WAM. Previously used SOPs will also be provided by the EPA WAM for concentration, sulfate removal, and freeze drying. Minor modifications by the contractor may need to be made on the concentration system which will be operated at the Cincinnati Waterworks Miller Plant. Equipment and SOPs will be provided by the EPA WAM for sulfate removal. The sulfate work will occur at the AWBERC facility. The freeze drying effort and GAC adsorption evaluation will also occur at the AWBERC facility.

BACKGROUND

Natural Organic Matter directly impacts drinking water treatment in many ways. Disinfectants used in the production of drinking water react with NOM in the source water to produce disinfection by-products (DBPs). NOM can also serve as a nutrient source for microbes found in drinking water treatment and distribution systems. Finally, treatment processes such as activated carbon, membranes, and ion exchange can get fouled by NOM. In current research, natural waters are almost always used to study NOM effects. However, there is no way to reproduce an experiment due to the ever changing natural environment. Therefore, there is a

great need to have access to a NOM source that is consistent and will provide reproducible results. This will greatly enhance research in DBP formation, corrosion, and treatment of contaminants of regulatory concern.

To address this gap, the EPA has built a concentration device consisting of ultrafiltration followed by ion exchange followed by reverse osmosis membrane concentration. The concentration system has been successfully used at a local water utility. To utilize the concentrate from this study, sulfate will be removed by barium precipitation. This will be done because the ultimate goal is to freeze dry the NOM concentrate so as to provide a stable sample over time. These steps have been previously demonstrated, although occasional optimization is needed, especially for the optimization of reverse osmosis concentration factor. Therefore, this project will have five phases 1) modify (as necessary) and operate the current NOM concentrating device which is now at the Miller plant of the Cincinnati Waterworks, (2) conduct treatment with barium to remove sulfate, (3) conduct the freeze drying process, (4) conduct rapid small scale column tests (RSSCTs) and pilot scale column tests with GAC using several waters matrices including water samples with varying amounts of reconstituted freeze-dried NOM and various VOCs, and (5) conduct chloramination testing and measure the resulting relevant disinfection byproducts in high concentration NOM solutions under conditions that simulate natural waters.

APPROACH

Task 1. Health and Safety Plan.

The Safety Plan (2013-019; last revised under EP-C-11-006 WA 2-14) shall be provided to the contractor by the EPA WAM. The Plan shall be updated and amended, as necessary, by the contractor with assistance from the EPA WAM to assure safe conduct of these studies with any needed chemicals, the treatment process, USEPA instruments, and any laboratories where the equipment will be operated. As needed, the EPA WAM may review the Safety Plan, make approved revisions, and explain the revised Plan to the contractor.

Task 2. Basic Research Quality Assurance Project Plan (QAPP).

The Quality Assurance Project Plan (QAPP) (738-Q-4-0) shall be updated and amended, as necessary, to assure that quality objectives are being met. The contractor shall comply with all requirements as delineated on the "Quality Assurance Planning Requirements Form" which will be provided by the EPA WAM.

The Quality Assurance Project Plan and SOPs shall be provided to the contractor by the EPA WAM and shall be fully understood before studies begin. As needed, the WAM may review the Quality Assurance Plan and SOPs, make approved revisions, and explain the revised Plans and SOPs to the contractor.

Task 3. Operation of NOM concentrator

The NOM concentration equipment is set up at the Cincinnati Waterworks (Miller Plant). The contractor shall be responsible for (a) preparing all waters; (b) affixing labels to water

quality samples for analysis; (c) operating the system according to protocols; (d) collecting all relevant samples; (e) analyzing all relevant background water quality samples; and (f) cleaning up the laboratory to restore the cleanliness that was present at the beginning of the experiments.

The EPA WAM will train the contractor on all aspects of operation of EPA equipment for contractor use. Operation shall commence when the EPA WAM and the contractor agree that, as a result of training, the contractor is skilled in the requirements of the protocols, SOPs, instrumentation, etc. It is anticipated that up to three collection experiments shall be completed over the Work Assignment Period of Performance. Up to three revisions to experiments, as communicated to the contractor by the EPA WAM in written technical directives (TD) may result from the EPA WAM's review of the results of these studies as they are being carried out.

Task 4. Sulfate removal and freeze drying

Following NOM concentration, the contractor shall remove sulfate from the concentrate and the contractor will freeze dry the remaining solution. It is anticipated that the phases will be completed in a sequential fashion after each collection experiment. This includes all three phases identified above: (1) NOM concentration, (2) sulfate removal, and (3) freeze drying.

The contractor shall modify the existing sulfate removal equipment and freeze drying equipment, as necessary and as communicated in written TDs from the EPA WAM, and operate the systems for processing NOM.

The contractor shall develop SOPs (where needed), Quality Assurance Plan revisions, log-book formats, data sheet formats and sample label formats. This shall be completed before data collection. The contractor shall obtain the necessary supplies to keep the operation going, such as cation exchange resin for the existing columns and other minor chemicals.

Task 5. Rapid Small Scale Column Tests (RSSCTs) and Pilot Scale Column Tests

The Contractor shall reconstitute several dried NOM samples and perform RSSCT testing to compare carbon adsorption before and after NOM concentration and freeze-drying. These NOM experiments shall be compared to parallel experiments conducted with natural source waters for comparison. In addition, a suite of 13 volatile organic contaminants (VOCs) will be tested in various RSSCT experiments to assess low concentration adsorption on GAC both with and without the reconstituted NOM. In order to evaluate scale-up considerations of the RSSCT VOC data, pilot scale experiments (one to three) will also be conducted. The VOCs include: benzene; carbon tetrachloride; 1,2-dichloroethane; 1,2-dichloropropane; dichloromethane; tetrachloroethylene (PCE); trichloroethylene (TCE); vinyl chloride; 1,3-butadiene; 1,1-dichloroethane; 1,2,3-trichloropropane; 1,1,2,2 and 1,1,1,2 tetrachloroethane. The contractor shall be responsible for VOC methods and analysis, on EPA equipment for contractor use. The contractor shall obtain necessary supplies to keep the operation going, such as vials and chemicals.

Task 6. Chloramination testing / disinfection byproduct formation in high concentration NOM solutions under conditions that simulate natural waters

The Contractor shall perform chloramination disinfection studies on several water matrices including natural water, concentrated NOM, and freeze-dried reconstituted NOM. The objective of these experiments is to determine appropriate concentrated NOM chloramination conditions to simulate natural waters. Success of the procedure will be assessed via the measurement of the 68 DBPs shown in Table 1. The chloramination procedure will be optimized when the DBPs in Table 1 are sufficiently similar in NOM concentrates and natural waters, differing primarily by the concentration factor of the NOM concentrates.

OUTPUTS

(1) In accordance with Task 1, the contractor shall write the annual update to the Safety Plan. The contractor shall demonstrate to the EPA WAM that appropriate contract staff have read and understood the Safety Plan. As needed, appropriate members of the contract staff shall sign the Safety Plan.

(2) In accordance with Task 2, the contractor shall write the annual update to the Quality Assurance Plan and any necessary SOPs. The contractor shall demonstrate to the EPA WAM that appropriate contract staff have read and understood the Quality Assurance Plan and the SOPs. As needed, appropriate members of the contractor staff shall sign the Quality Assurance Plan.

(3) The contractor shall provide raw data from Tasks 3, 4, 5, and 6 in the form of spreadsheets as they become available. After EPA WAM review, the raw data may be further analyzed by the contractor and resubmitted.

Table 1: List of 68 Targeted DBP Components

Haloketones	**Haloamides**
Chloropropanone	Chloroacetamide
1,1-Dichloropropanone	Bromoacetamide
1,3-Dichloropropanone	Dichloroacetamide
1,1-Dibromopropanone	Bromochloroacetamide
1,1,1-Trichloropropanone	Dibromoacetamide
1,1,3-Trichloropropanone	Trichloroacetamide
1-Bromo-1,1-dichloropropanone	Bromodichloroacetamide
1,1,1-Tribromopropanone	Dibromochloroacetamide
1,1,3-Tribromopropanone	Tribromoacetamide
1,1,1,3-Tetrachloropropanone	**Halocyanides**
1,1,3,3-Tetrachloropropanone	Cyanogen chloride
1,1,3,3-Tetrabromopropanone	Cyanogen bromide
Pentachloropropanone	**Nitrosamines**
Oxyhalides	N-nitrosodiethylamine (NDEA)
Bromate	N-nitrosodimethylamine (NDMA)
Chlorate	N-nitroso-di-n-butylamine (NDBA)
Iodate	N-nitroso-di-n-propylamine (NDPA)
Inorganics	N-nitroso-methylethylamine (NMEA)
Bromide	N-nitrosopiperidine (NPIP)
Iodide	N-nitroso-pyrrolidine (NPYR)
Trihalomethanes (THM10)	**Haloacetic Acids (HAA9)**
Chloroform	Chloroacetic Acid
Bromodichloromethane	Dichloroacetic Acid
Dibromochloromethane	Trichloroacetic Acid
Bromoform	Bromoacetic Acid
Dichloroiodomethane	Dibromoacetic Acid
Bromochloroiodomethane	Tribromoacetic Acid
Dibromoiodomethane	Chlorobromoacetic Acid
Chlorodiiodomethane	Bromodichloroacetic Acid
Bromodiiodomethane	Dibromochloroacetic Acid
Iodoform	**Iodoacetic Acids (IAA3)**
Haloacetonitriles	Bromoiodoacetic acid
Dichloroacetonitrile	Chloroiodoacetic acid
Bromochloroacetonitrile	Diiodoacetic acid
Dibromoacetonitrile	**Other DBPs**
Trichloroacetonitrile	Chloral Hydrate
Halonitromethanes	Total nitrosamines (TONO)
Chloropicrin	**Total organic halogen speciation**
Bromopicrin	Total organic bromide
	Total organic iodide

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-14

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	09/30/2015 To 09/29/2016 Base X Option Period Number	Concentrating NOM from Water

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	4.C

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

Period of Performance: From 09/30/2015 To 09/29/2016

Comments:
The purpose of this amendment is to add Task 7 and associated deliverables to the work assignment, all other tasks and deliverables 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: 09/30/2015 To 09/29/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Jonathan Pressman	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7625 FAX Number:
Project Officer Name Michael Moeykens	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7196 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
Contract No. EP-C-15-010
WA 0-14, Amendment 1

Title: Concentrating Natural Organic Matter from Water Matrices

Work Assignment Manager (WAM):

Jonathan Pressman
Treatment Technology Evaluation Branch
Water Supply and Water Resources Division
U.S. EPA National Risk Management Research Laboratory
Cincinnati, Ohio 45268
Phone: 513-569-7625

Project Period: **CO Issuance through September 29, 2016**

Purpose:

The purpose of this amendment is to add the language below as a new Task, Task 7, with a data delivery output. All other tasks and outputs remain the same.

Task 7: Volatile Organic Compounds (VOC) Analysis

The contractor shall analyze up to 50 samples for trichloroethene, cis-1,2-dichloroethene, vinyl chloride, benzene, chloromethane, and bromodichloromethane. The method of analysis shall be Modified EPA Method 524.3 and shall occur within 14 days of sample receipt.

The Contractor shall accept delivery of the samples (HCl preserved samples in 40 mL Volatile Organic Analysis vials, packed on ice) at AWBERC. The samples shall be analyzed within the holding time of 14 days. Quantitation Limits required are as follows: TCE (0.5 ppb); cis-DCE (1 ppb); VC (0.5 ppb); chloromethane (1 ppb); benzene (0.5 ppb); bromodichloromethane (1 ppb). An MS/MSD (Matrix Spike/Matrix Spike Duplicate) and LCS (Laboratory Control Sample) needs to be analyzed for every 20 samples received (QA/QC in Table 1 below). Samples collected from wells MW13, MW13dup, MW18, MW35, MW38, MW46, MW47, MW48, MW49, MW50, and MW52 shall be collected in duplicate to avoid the possibility that breakage of the glass vials impacts samples analysis from these sites. The duplicate samples do not need to be run in duplicate.

Data deliverables are required in electronic format, requiring standard lab narrative and an Excel spreadsheet. The data report shall be reported to Rick Wilkin via email at Wilkin.Rick@epa.gov

OUTPUTS

The data outcome of this project, standard lab narrative and an Excel spreadsheet, shall be provided to the EPA WACOR no later than 20 days after the samples arrive at AWBERC.

Table 2. QA/QC Requirements for VOC analysis.

Measurement	Analysis Method	Blanks (Frequency)	Calibration Checks (Frequency)	Second Source (Frequency)	Duplicates (Frequency)	Matrix Spikes (Frequency)
Volatile organic compounds (VOC)	Modified EPA Method 524.3	<MDL (Beginning and end of each sample set and every 20 samples)	80-120% Rec. (Beginning, end, and every 20 samples)	80-120% of known value Once at beginning	RPD≤20 for results >5xQL (every 20 samples)	70-130% Rec. (every 20 samples)

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-15

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	09/30/2015 To 09/29/2017 Base X Option Period Number	Cyanobacteria Nutrient Demand

Contractor: PEGASUS TECHNICAL SERVICES, INC.

Specify Section and paragraph of Contract SOW: A - 1

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

Period of Performance: From 08/17/2016 To 09/29/2016

Comments:
LOE 119 hours

☐ 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: 09/30/2015 To 09/29/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Heath Mash	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7713 FAX Number:
Project Officer Name Michael Moeykens	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7196 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
Contract No. EP-C-15-010
WA 0-15

Effects of nutrient demand and chemical oxidation on various cyanobacteria in drinking water treatment

Work Assignment Contracting Officer's Representative (WACOR):
Heath Mash
513-569-7713
heath.mash@epa.gov

Alternate WACOR: **Jeff Adams**
513-569-7835
adams.jeff@epa.gov

Period of Performance: **Work Plan Approval through 09/29/16**

Location: **On-site**

LOE: 119 hours

1. Project Background

Climate change, population growth, increased agricultural use of nutrients and anthropogenic stressors are increasing the likelihood of the presence and persistence of harmful algal blooms (HAB) in body resources, especially those used as drinking water sources. Specifically, HAB are defined as cyanobacteria that produce toxins hazardous to both humans and animals. The three most common cyanotoxins in the United States are anatoxin-a, microcystin-LR and variants and cylindrospermopsin. Environmental factors, such as elevated temperatures over prolonged time periods, increased loading of reactive nitrogen (N) and phosphorus (P) increase the probability of toxins breaking through to consumers' taps. However, both anatoxin-a and microcystins are found to be intracellularly bound approximately 95% of the time during the growth stage of the bloom. Thus, conventional treatment is fairly effective in the removal of these toxins via the flocculation/sedimentation process where most of the cyanobacteria mass is removed. Extracellular release of these toxins can result in decreasing the effectiveness of conventional water treatment and increasing the possibility of toxins migrating into the distribution system. The influence of environmental factors such as nitrogen and phosphorus availability and N/PO4 ratios are known to stimulate/limit cyanobacteria growth. However, these variables have not been studied as it relates to the possibility of extracellular toxin release.

The tasks of this work assignment will be carried out by performing bench-scale studies to demonstrate the influence of nutrients on the lifecycle, cell integrity and possible toxin release of several strains of cyanobacteria.

This work assignment will utilize contractor personnel to: (1) maintain and operate current and potentially new bench scale studies, (2) conduct simple chemical analyses (e.g., pH, nitrates, phosphates, temperature, etc.), (3) make observations of the cyanobacteria and document those results utilizing spectroscopic and microscopic methodologies (e.g., cell staining, SEM, TEM, chlor-a, etc.) in accordance with existing sample preparation and analysis protocols; and (4) make and document modifications to those protocols if necessary. These studies will be conducted at WSWRD using division equipment and experimental resources.

2. APPROACH

(a) Health and Safety Plan

WSWRD currently has a general laboratory operational safety plan, which is applicable to assure safe conduct of sample preparation and analysis using WSWRD instruments. The WACOR will provide the Safety Plan to the contractor. The contractor shall read and understand the Safety Plan before studies are begun. As needed, the EPA WACOR may review the Safety Plan, make approved revisions, and explain the revised Plan to the contractor. The contractor is free to comment on the existing Safety Plan.

(b) Basic Research Quality Assurance Project Plan (QAPP)

Quality Assurance Project Plan (QAPP) is in place, covering all instrumentation used in this project. The QAPP describes protocols for sample analyses, methodology for sample preparation, and standardizations. The QAPP refers to relevant WSWRD SOPs. The EPA WACOR will provide the QAPP and SOPs to the contractor. They are also included as attachments in EAS to be sent via FedConnect. The contractor shall read and understand the QAPP and SOPs before the studies begin. Also, other studies may have specific quality assurance needs that will require a separate QAPP. This will be study specific and will be provided to the contractor. As needed, the EPA WACOR may review the current QAPP and SOPs and make approved revisions. The contractor may be required to offer input into the formation or revision of any QAPP or SOP, but will not be responsible for formally making the revisions.

QA-Level: Sampling and Analysis, Category 3 = Applied Research

Applicable QAPPs include:

W-19082-QP-1-0; W-18506-SP-1-0

QAPPs for specific future studies will be developed by the EPA WACOR prior to project initiation as needed.

(c) Work / Experimental Requirements

(1) The contractor shall maintain and operate current and potentially new bench studies. The contractor shall use protocols, SOPs, a Quality Assurance Plan, a

Safety Plan, notebook formats, data sheet formats, computerized software, and sample label formats provided by the EPA WACOR. All supplies, equipment, and instrumentation will be provided by WSWRD. Study activity shall include: (a) maintenance of cyanobacteria cultures; (b) conduct bench-scale experiments to test the influence of nitrogen and phosphate at various concentrations on up to 3 strains of cyanobacteria; (c) prepare sub-samples for use by EPA personnel as requested via written technical direction; and (d) literature searches as needed. Cultures will be available on the PoP start date.

(2) The contractor shall have basic knowledge in the use of optical microscopes and shall be familiar with various simple chemical analyses such as pH, nitrates, phosphates, temperature, etc. The EPA WACOR will train the contractor on all aspects of the protocols, SOPs, location and storage of reagents, sample preparation, and operation of instruments. The EPA WACOR will again train the contractor upon the addition of, or revisions to protocols, SOPs, software, or instruments. Additions or revisions may result from the EPA WACOR's review of the results of these studies. Studies shall commence when the EPA WACOR and the contractor agree that, as a result of training, the contractor is skilled in the requirements of the protocols, SOPs, instrumentation, etc.

(3) In the conduct of these studies, the contractor shall maintain a laboratory notebook provided by the EPA WACOR. Data shall be maintained either in the laboratory notebook and/or in electronic form. The contractor shall record in the notebooks the date, time, and shall describe studies conducted, observations, cross-references to data sheets, and electronic spreadsheets and sample labels, etc. Notebooks should also record all problems. A review of project status and outcomes shall be provided to the EPA WACOR on a weekly basis. Electronic data file updates (excel, etc) shall also be provided weekly or as available.

(4) The contractor shall prepare reports (2-4) for bench-scale studies as indicated by the EPA WACOR via written technical direction, which combine analytical data from all different experiments and observations performed by the EPA and the contractor, and which will include evaluation of data quality based on application of various QA protocols. When appropriate, the contractor shall prepare or contribute to preparing short technical journal manuscripts (1-2) in scientific collaboration with EPA. The manuscript shall report the results of contractor experimental and analytical studies performed under this WA.

(d) Progress Meetings

The contractor shall participate in informal meetings with the EPA WACOR to review the progress of the studies, and to discuss problems with the sample preparation or analysis activities. If appropriate, other EPA staff may attend these meetings at the request of the WACOR. Examples would include WSWRD's QA Officer and a representative of AWBERCs Safety Office. These meetings will occur at the AWBERC every week on dates and times agreed upon by the contractor and the WACOR.

3. Expected Outputs

(1) The contractor shall assure the EPA WACOR that appropriate contractor staff have read and understood the Safety Plan. If needed, appropriate members of the contractor staff will sign the Safety Plan.

(2) The contractor shall assure the EPA WACOR that appropriate contractor staff have read and understood the Quality Assurance Plan and the SOPs. As needed, appropriate members of the contractor staff will sign the Quality Assurance Plan.

(3) The contractor shall complete notebooks, computerized forms, and data sheets in the formats indicated by the EPA WACOR via written technical direction. Notebooks, analytical instrument output electronic files and data sheets shall be presented to the EPA WACOR (a) on a bi-weekly basis, (b) at the completion of each experimental phase, or (c) at the contractor's request when a deviation from the protocols, SOPs, Safety Plan, Quality Assurance Plan or reporting formats may be appropriate. Completion of notebooks, instrument analytical output files and data sheets indicates that, in the conduct of the studies, all requisite experiments have been completed and analyzed according to protocols and SOPs.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-16

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	To	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X	Option Period Number	LABORATORY AND ANALYTICAL SUPP

Contractor: PEGASUS TECHNICAL SERVICES, INC.

Specify Section and paragraph of Contract SOW: Section 4 (B) and (C)

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

Period of Performance: From 09/30/2015 To 09/29/2016

Comments:
The contractor shall immediately start work on all tasks listed in the Work Assignment Performance Work Statement.

☐ 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 (Max 7)
1										
2										
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Authorized Work Assignment Ceiling

Contract Period: To — 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 Souhail Al-Abed	(Signature)	(Date)	Branch/Mail Code:
			Phone Number 513-569-7849
			FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7196
			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

CONTRACT NO. EP-C-15-010

WORK ASSIGNMENT NO. 0-16

IMMEDIATE START

LABORATORY AND ANALYTICAL SUPPORT IN THE AREA OF NANOMATERIALS

WORK ASSIGNMENT CONTRACTING OFFICER'S REPRESENTATIVE:

Souhail Al-Abed
513-569-7849
Al-Abed.Souhail@epa.gov

ALT. WACOR: **Anthony Zimmer**
513-487-2426
zimmer.anthony@epa.gov

PERIOD OF PERFORMANCE: **CO Issuance through Sept. 29, 2016**

LOCATION: **On-Site**

1. Review Project Background:

In the recent years, nanotechnology has seen a dramatic increase in various applications in environmental, medical, chemical and pharmaceutical industries. Nanomaterials (NMs) are a relatively new class of compounds that are globally manufactured in hundreds to thousands of metric tons per year and play a significant role in most of the nanotechnology based innovations. Their widespread production and application is expected to increase dramatically over the next decade, which will inevitably lead to their release into the environment. Past and current research has emphasized the need of research on the environmental risks and health effect of NMs in parallel with the development and application. The potential of such NMs is to solve many challenges in almost all the sectors of modern life (i.e., new medical applications for curing cancer and other diseases, production of water in developing and marginal rural areas around the world, etc. However, large amounts of NMs are produced from point and non-point sources, distributed to users, and finally released to the environment without notice. As a result, fundamental research of the chemical and physical properties of NMs before and after entering the environment (especially from consumer products) is an essential step to assess their potential risks of

acute or chronic contamination events related to their release into environmental vectors (e.g. water, soil, landfill etc)

In addition to their smaller particle size, engineered Nanomaterials (NMs) possess unique characteristics such as large surface to volume ratio, chemical reactivity and their biocompatible surface properties. Even though the improved properties of the NMs are advantageous to their use in various applications, the same activity may contribute to a more aggressive form of long-term toxicity. Due to the relative novelty of this technology, risk assessment on the potential impact of NMs use on human health and environment is relatively unknown and thus, there is an immediate need to focus the attention on the possible toxicological risks to human health that may be presented by the use of NMs. Generally, the transport and fate of NMs is complex and are substantially influenced not only by their own properties (e.g., size, composition, purity) but also by the environment conditions surrounding them (e.g., sunlight, temperature, pH, microbiology). Other potential transformation processes of NMs include diffusion, agglomeration, wet and dry deposition, and gravitational settling. Most of them are subject to diffusion, dispersion, agglomeration, and settlement in water. Thus, it is vitally important to understand the linkage between the NMs and the environment and what factors influences their transformations or how the NMs influence the already existing contaminants present in soils/sediments/aquatic systems.

2. Prepare Health and Safety Plan (HASP)

The contractor shall develop and/or update Health and Safety Plans relevant to the PWS objectives at the direction of the WACOR.

3. Prepare/ Modify Quality Assurance Project Plan (QAPP)

QA-Level: III

The contractor shall use and if needed amend the following QAPPs based on the nano materials used in the research when the WACOR requests via written technical direction.

1) 1. QAPPs: L10453-QP-1-3, 583-Q15-0, L17791-QP-1-1, L-14158-QP-1-0, L-16811-QP-1-2, 583-Q15-0, 583-Q2-1 and 583-Q10-0.
2) QAPP L-19782-QP-1-1 entitled 'Electron Microscopy (EM) Analysis for the Characterization of Nanomaterials: Impact of Sample Preparation on EM's Data Quality'
3) QAPPs, entitled "Inherent Properties of Nanosilver as a Cleaner in Dental Unit Waterline" and "Quantitative Detection of Carbon Nanotubes in Environmental Samples by Microwave Induced Heating" were modified and approved (L-17791-QP-1-3 and L-19953-QP-1-2).
4) Environmental Characterization of Silver Nanoparticles (L11754-QP-1-4)

Additional information on how to develop QAPPs can be found in the following web resources:

http://www.epa.gov/quality/ http://www.epa.gov/quality/qa_docs.html Specific guidance on developing Quality Assurance Project Plans can be found at http://www.epa.gov/quality/qapps.html

4. Work / Experimental Requirements:

The contractor shall complete the following tasks:

(a) Synthesize metallic silver, carbon nanotubes, copper, copper carbonate and copper oxide NMs using methods available in the peer-reviewed literature, purify and quantify mass of NMs and ionic forms present in the suspension.

(b) Perform characterization studies on NMs to determine their morphological and surface characteristics using microscopic (e.g., (FE)-SEM, HR-TEM, Zeta potential, particle size, BET, AFM), and spectroscopic (e.g., XAS, XPS, XRF, FTIR, EPR, NMR) techniques. Develop methods to detect carbon nanotubes using microwave-based techniques. Evaluate stability/aggregation under various environmental conditions specified via written technical direction of the WACOR.

(c) Develop protocols to evaluate the leaching/release of NMs from various consumer products in different matrices (liquid, solid).

(d) Develop experimental studies on determining the mobility of the nanomaterials that come from consumer products through porous media (sand, clay or sediment). Examine the effect of natural organic matter (humic substances) on the mobility of nanomaterials in porous media. Examine interactions of NMs with soil, sediments, landfill leachate, and water constituents. Evaluate the effect of matrix chemistry on the fate of nanomaterials. Investigate nanoparticles behavior in the presence of various environmental stressors.

(e) Develop experimental studies on determining the reactivity of NMs having various sizes, shapes and surface chemistry towards toxic contaminants such as arsenic, chromium and numerous organic pollutants, under aerobic and anaerobic conditions. Use DNA sequencing and microbial diversity analysis techniques to support a more in-depth understanding of the toxicity of NMs at the micro-level.

(f) Develop the methodology to understand the behavior and characteristics of NMs in consumer products. Assess the behavior of coated and un-coated nanomaterials when in contact with various environmental stressors and water

types. Evaluate the reactivity and potential (photo) activity when the surface is damaged.

(g) Develop methods, design and conduct experiments to evaluate the dissolution kinetics of silver and copper NMs having various shapes, sizes and surface chemistry. Use experimentally determined dissolution data to model dissolution kinetics of silver and copper NMs.

5. Progress Meetings:

Weekly progress meetings will be held with the EPA WACOR. Technical direction and alternations to the experiments from the WACOR will be discussed during the weekly progress meetings. If an alternation to an experiment is too significant, a work assignment amendment will be issued.

6. Expected Outputs:

(a) The contractor shall provide the data from the experiments in spreadsheets format (EXCEL) including QA parameters and the analytical procedures followed by our staff in Word. Provide laboratory notebooks formatted according to SOP # 16 (to be provided separately by the WACOR).

(b) The contractor shall purchase consumables as necessary. Please consult with the WACOR prior to purchase to be certain there are not supplies on-site that may be utilized.

(c) The contractor shall attend and present posters and talks at national/international meetings as requested by the EPA WACOR through written technical direction. All travel shall be approved by the Project officer in accordance with the contract clause. EPA expects 1 to 2 of these events, locations are not yet known. National meetings shall not exceed 4 days. International meetings shall not exceed 10 days. The contractor shall present findings from the research identified in this WA in forms of presentations, seminars, and posters. They may also co-organize symposiums during the conference and participate in panel discussions.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-16

☐ Other ☒ Amendment Number: 000001

Contract Number: EP-C-15-010

Contract Period: 09/30/2015 To 09/29/2016

Base X Option Period Number

Title of Work Assignment/SF Site Name: Laboratory and Analytical Supp

Contractor: PEGASUS TECHNICAL SERVICES, INC.

Specify Section and paragraph of Contract SOW: Section 4 (B) and (C)

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

Period of Performance: From 09/30/2015 To 09/29/2016

Comments:
The purpose of this amendment is to add Task h to the work assignment, all other tasks and deliverables remain the same.

☐ 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: 09/30/2015 To 09/29/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Souhail Al-Abed
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-569-7849
FAX Number:

Project Officer Name: Michael Moeykens
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-569-7196
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

Contract No. EP-C-15-010

WA 0-16, Amendment 1

Title: Optimization of the Fe/Pd impregnated on reactive activated carbon (RAC) system for dechlorination of PCBs in water, and sediments

Work Assignment Manager (WAM):

Souhail Al-Abed

Waste Management Branch

Land Remediation and Pollution Control Division

U.S. EPA National Risk Management Research Laboratory

Cincinnati, Ohio 45268

Phone: 513-569-7849

Project Period: CO Issuance through 9/29/16

The purpose of this amendment is to add Task h to the work assignment, all other tasks and deliverables remain the same. This task deliverable will be due on September 29, 2016

(h) The purpose of this task is to improve the performance of the catalytic system consisting of the Iron oxide and Palladium deposited on activated carbon matrix. At the same time it is intended to increase the cost efficiency of the system by minimizing the content of palladium, without decreasing the overall performance of the system. The following subtasks shall be performed:

1. The contractor shall perform modification of the existing preparation method by EPA aiming to maximize the contact between the Iron oxide and Pd phase on the RAC. The WACOR will provide the EPA methods documented in approved QAPPs (L20755-QP-1-1 and peer review journal articles to the contactor. The modifications include applying new wet chemistry methods to force co-deposition of Fe and Pd in close proximity. The new applied methodology will be focused on using green chemistry aspects of the process, particularly on the decrease of use of hazardous chemicals, waste minimization and solvent use reduction and recycling.
2. The contractor shall perform chemical characterization of the new refined formulations in Subtask1. Specifically, the contractor should examine the relative location of Pd and Fe clusters on the catalyst, and potential electronic effects between the Fe and Pd, which will be manifested as changes in the electron density around the central atoms. Such interactions should indicate a contact interaction between Fe and Pd.
3. The contractor should perform testing of refined formulations in 2-chloropbiphenyl dechlorination in batch system with both original and refined formulations. Analysis should also be performed for the presence of reaction products and by-products. The results will be compared to the performance of original Fe-Pd system.

4. The contractor shall test the Fe/Pd system on contaminated sediments from Lower Duwamish EPA site using columns.
5. The contractor shall write and/or modify the current approved QAPP (L20755-QP-1-1) to include the new work as stated in the four subtasks.
6. A draft manuscript with the results shall be prepared as a deliverable by September 29, 2016.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-17

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X To Option Period Number	Life Cycle Inventories for C&D

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	4E and 4H

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

Period of Performance: From 10/05/2015 To 09/30/2016

Comments:
The contractor shall immediately start work on all tasks listed in the Work Assignment Performance Work Statement.

☐ 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 (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: To — 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 Thabet Tolaymat	(Signature) (Date)	Branch/Mail Code: Phone Number 513-487-2860 FAX Number:
Project Officer Name Michael Moeykens	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7196 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:

I. **Title: Life Cycle Inventories for Construction and Demolition Debris.**
Contractor Name: PTS
Contract #: EP-C-15-010

II. **Work Assignment Contracting Officer's Representative (WACOR):**

Name: Thabet Tolaymat
Office: ORD/NRMRL/LRPCD
Address: Mail code: CHL
26 West MLK Drive
Cincinnati, Ohio 45268
Phone: 513-487-2860
FAX: 513-569-7879
E-mail: tolaymat.thabet@epa.gov

Alternate WACOR: Souhail Al-Abed 513-569-7849

III. **Period of Performance:** CO Issuance – September 29, 2016

IV. **Background:**

The purpose of this work assignment is to: develop life cycle emissions data to conduct life cycle assessment of construction and demolition debris. The project will provide information that would allow EPA to implement better decision making with regards to sustainable materials management. Specifically this WA aims at

- Determining the chemical composition (total metal content, metal and sulfur speciation and geochemical association) and mineral phases of commercial drywall used in the US market and other C&D debris
- Determining metal and sulfur leaching from commercial drywall and other C&D debris as well as the combinations of wastes under various disposal scenarios such as temperature and liquid composition.

To achieve this purpose the contractor shall be expected to: conduct experiments to generate data, evaluate secondary data, and conduct virtual and in person meetings with key members of the research community. Construction and Demolition (C&D) debris is part of the municipal waste stream and is generated from the construction, renovation, repair, and demolition of structures such as residential and commercial buildings, roads, and bridges. The composition of C&D waste varies for these different activities and structures. Overall, C&D waste is composed mainly of wood products, asphalt, drywall, and masonry; other components often present in significant quantities include metals, plastics, earth, shingles, insulation, and paper and cardboard. It is often disposed of in unlined impoundments with little or no effluent collection system. This management process is becoming more and more unsustainable as effluent from these impoundments is causing groundwater and air contamination. Furthermore, this disposal process is proving to be a disincentive for generators to recycle these types of materials. The research proposed for this work assignment will evaluate emissions from C&D dumpsites and aims at promotion of recyclability and protection of human health and the environment.

IV. **Description and Tasks:**

Task 1: Work Plan

The contractor shall develop a work plan that describes how each task will be carried out. The work plan shall include a schedule, staffing plan, level of effort (LOE), and cost estimate for each task, the contractor's key assumptions on which staffing plan and budget are based, and qualifications of proposed staff. The work plan shall also provide an analysis of the existing and projected constraints, and the feasibility of accomplishing the project's purpose.

In addition, the contractor shall prepare quality assurance project plan(s) QAPP(s) and ensure the quality of the secondary data used to complete these tasks. The work plan shall explain when the QAPP(s) will be submitted based on the specific data requirements of the WA. The contractor shall immediately notify the Contract Level – Contracting Officer's Representative (COR) and WACOR if any changes to the tasks involving the collection and analysis of the data occur, and prepare a new or modified QAPP(s), as needed, supplementing the previous QAPP(s). Work on these tasks cannot proceed until the contractor receives notification of the new QAPP(s) approval via e-mail. This task also includes monthly progress and financial reports. The monthly progress report shall indicate, in a separate QA section, whether significant QA issues have been identified and how they are being resolved. Monthly financial reports must include a table with the invoice LOE and costs` broken out by the tasks in this WA. The contractor shall present these reports to the WACOR during a monthly progress meeting.

In addition, in each monthly progress report and meetings, the contractor shall, at the introduction to the discussion of this work assignment, discuss actual progress toward achieving the purpose of this work assignment, including problems encountered, issues that may need to be resolved, and anticipated timing for completing the goals of the work assignment.

Deliverables: Work plan, QAPP(s) and monthly progress and financial reports, monthly progress meetings.

Task 2: Chemical Composition and Mineral Phases of Drywall and C&D Debris
Different commercially available drywall and concrete mixes will be used for this experiment. Drywall sample: At least 10 different commercial drywalls will be investigated, which include the Regular, Mold & Moisture Resistant, Fire Resistant, and recycled drywall.

Mineral phases
The mineral phase of different commercially available drywall will be investigated using XRD initially (SOP1). Scanning electron microscopy (SEM) with Energy-dispersive X-ray analysis (EDX), transmission electron microscopy (TEM), and X-ray photoelectron spectroscopy (XPS) will be used when necessary.

Metal and chemical composition

- Total S, and N will be measured by EA-IRMS.
- Total metals after microwave digestion.
- Water extractable SO_4 will be tested, which will be based on the work of Musson et al (2008) (Musson et al., 2008). The liquid to solid ratio is set at 20 to 1, the sample is shaken at 100 rpm at ambient temperature for 30 min with repeated replacement of deionized water (DIW). This is repeated 5 to 10 times until the conductivity of the leachate is less than 500 uS/cm.
- HCl extractable SO_4 will be investigated, based on the work of Sun and Barlaz (2015) (Sun and Barlaz, 2015). The liquid to solid ratio is set at 10, the sample is shaken at 100 rpm at ambient temperature for 1 h, 18 h and 5 days with 0.25M HCl.

- S species by chemical extractions

Deliverable: Data set with results for the mineral phases and composition of drywall and concrete mixes.

Task 3: Kinetic Leaching Study
A set of kinetic (time based) leaching studies shall be conducted to explore the time factor for metal and sulfur release (DIW, L/S = 10, time: 30 min, 1h, 4h, 8h, 18h, 3 d (72h), 5 d (120 h), 10d (240 h), and 1 month (720 h)).

- Target parameters include the metal and S composition of leachate (e.g., Ca, As, Pb, Zn, Se and Sr). The dissolved SO_4^{-2}, total alkalinity, leachate pH and electrical conductivity (EC) also will be monitored. Total S, total organic C and N will be analyzed from the solid residue.
- Drywall sample: Regular, Mold & Moisture Resistant, Fire Resistant and one recycled drywall will be investigated (at least 4 samples).
- The leachate pH, EC, and total alkalinity will be measured after the solution is filtered using different size filters. Part of the solution will be preserved with trace metal grade concentrated HNO_3 for the metals analysis and the remaining solution will be used for IC analysis (cations and anions). All solutions will be kept in the High Bay refrigerator (2-4°C) while stored at EPA Center Hill Facility.

- Additionally, the solid residues will be collected and freeze dried for further analysis as needed.

Deliverable: Data set with results for time impact on leaching from drywall.

Task 4: Liquid to Solid Ratio Leaching Study (USEPA Method 1316)
The parallel liquid to solid ratio batch procedure (L/S from 0.5, 1.0, 2, 5, 10, 20 up to 50) will be used as the main leaching process to monitor the changes from the different drywalls, C&D debris and their combinations, following the procedure of USEPA Method 1316 (Andrew C. Garrabrants et al., 2012a).

- Based on the results of the kinetic studies, we will modify the equilibrium time in the parallel liquid to solid ratio batch procedure (Method 1316).
- Drywall sample: Regular, Mold & Moisture Resistant, Fire Resistant and once recycled drywall will be investigated (at least 3 types).
- Target parameters include the metal and S composition of leachate (e.g., Ca, As, Pb, Zn, Se and Sr). The dissolved SO_4^{-2}, total alkalinity, and leachate pH and EC also will be monitored. Total S, total organic C and N will be further analyzed from the solid residue.
- The residues from the end of leaching processing will be freeze dried for mineral analysis and sulfur species analysis.

Deliverable: Data set with results of liquid to solid ratio impact on leaching from drywall.

Task 5: Mass Transfer Rate Leaching Study *USEPA Method 1315*
The Mass transfer rates of parallelepipeds drywall (drywall sheet directly) and/or its mixture using a semi-dynamic tank leaching procedure will be studied, following the procedure of USEPA Method 1315 (Andrew C. Garrabrants et al., 2012b). This method comprises leaching of a continuous water saturated drywall sheet as parallelepipeds in an eluent filled tank with periodic renewal of the leaching solution. The vessel and sample dimensions are chosen such that the sample is fully immersed in the leaching solution. Samples are in contact with reagent water at a specified liquid to area ratio (L/A). The leaching solution is exchanged with fresh

reagent water at nine pre-determined intervals. The sample is freely drained and the mass is recorded to monitor the amount of eluent absorbed into the solid matrix at the end of each leaching interval. The eluate pH and specific conductance is measured for each time interval and analytical samples are collected and preserved accordingly based on the determinative methods to be performed. Eluate concentrations are plotted as a function of time, as a mean interval flux, and as a cumulative release as a function of time.

- Drywall sample: Regular, Mold & Moisture Resistant, Fire Resistant and once recycled drywall will be investigated (at least 4 types).
- Target parameter include the metals and S composition of leachate (e.g., Ca, As, Pb, Zn, Se and Sr). The dissolved SO_4^{-2}, total alkalinity, leachate pH and EC also will be monitored. Total S, total organic C and N will be further analyzed from the solid residue.
- Particle size will be separated using different filter sizes; the sizes will be 5.0, 0.45, 0.05 and 0.025 um. The standard size is 0.45 um.
- The residues from the end of leaching processing will be freeze dried for mineral analysis and sulfur species analysis.

Deliverable: Data set with results for mass transfer rate of contaminants from different types of drywall

Task 6: Long-term releases of metal(loid)s from different drywall, C&D debris and their combinations

Many factors can significantly impact the metals and metalloids release. Meanwhile, some colloids also can form during the release process (Cornelis et al., 2008; Engelsen et al., 2010; Schmukat et al., 2013; Schmukat et al., 2012; Van Der Sloot, 2000). The key factors include the combination of these wastes and the environmental conditions of the wastes. Traditionally, drywall and concrete are the main components for C&D debris in landfills (USEPA, 1998; USEPA, 2014). The ratio of the drywall and calcium carbonate, the main component of concrete, might play a role in metals release (Al-Barrak and Rowell, 2006; Herrero et al., 2009; Müllauer et al., 2012; Sheikholeslami and Ng, 2001; Sudmalis and Sheikholeslami, 2000). Meanwhile, the CO_2 concentration is also a key factor in the dissolution of carbonate and gypsum (Al-Barrak and Rowell, 2006; Van Gerven et al., 2004).

- Drywall and calcium carbonate mixture: The weight ratio of regular drywall and calcium carbonate will be 1:0, 1:1, 1:5, 5:1, and 0:1 only (at least 7 sample).
- CO_2 concentration: The control is the fresh DIW, the other treatments are DIW after bubbling with air, 5% CO_2 and 20% CO_2, respectively.
- Particle size will be separated by filter, 0.45 um.
- Target parameters include the metals and S composition of leachate (e.g., Ca, As, Pb, Zn, Se and Sr). The dissolved SO_4^{-2}, total alkalinity, leachate pH and EC also will be monitored. Total S, total organic C and N will be further analyzed from the solid residue.
- The residues from the end of leaching process will be freeze dried for mineral analysis and sulfur species analysis.

Deliverable: Data set with results for Long-term releases of metal(loid)s from different drywall, C&D debris and their combinations

V. Schedule:

Task #	Deliverable	Schedule
1	Draft QAPP(s)	10 days after award
	Final QAPP (s)	1 month after award
	Update QAPP (s)	As needed by research
2	Draft data set with results for the mineral phases and composition of drywall and concrete mixes	6 months after QAPP approval
	Final data set with results for the mineral phases and composition of drywall and concrete mixes.	8 months after QAPP approval
3	Draft data set with results for time impact on leaching from drywall	6 months after QAPP approval
	Final data set with results for time impact on leaching from drywall	8 months after QAPP approval
4	Data set with results of liquid to solid ratio impact on leaching from drywall	8 months after QAPP approval
	Final data set with results of liquid to solid ratio impact on leaching from drywall	10 months after QAPP approval
5	Draft data set with results for mass transfer rate of contaminants from different types of drywall	8 months after QAPP approval
	Final data set with results for mass transfer rate of contaminants from different types of drywall	10 months after QAPP approval
6	Draft data set with results for Long-term releases of metal(loid)s from different drywall, C&D debris and their combinations	8 months after QAPP approval
	Final data set with results for Long-term releases of metal(loid)s from different drywall, C&D debris and their combinations	10 months after QAPP approval

VI. Reporting Requirements:

The Contractor shall provide monthly progress reports in accordance with the terms of the contract. The Contractor shall submit work products in electronic as well as hard copy form. In addition, the Contractor shall deliver to the WAM each draft and final report in electronic format that is readable by windows-based word-processing (Microsoft Word 2013), graphics (Microsoft PowerPoint 2013), spreadsheet (Excel 2013), and database (Access 2013) programs. The Contractor shall also provide electronic copies of reports in PDF format. All deliverables have to be 508 compliant.

Quality Assurance

All research activities which generate data must follow the guidance of ORD policy and procedures manual section 13.4, *Minimum QA\QC Practices for ORD Laboratories Conducting Research*: PPM 13.4 Training.

Research records shall follow the applicable policy for laboratory notebooks, according to ORD policy and procedure manual section 13.2, *Paper Laboratory Records*: PPM 13.2 Training.

Copies of the current Quality Assurance policies may obtained here: Chapter 13 Policy and Procedures Manual.

When applicable, the contractor shall follow SOPs published by LRPCD at http://intranet.ord.epa.gov/p2/nrmrl/standard-operating-procedures-technical-lrpcd. As SOPs are revised and new SOPs are published, the list of approved SOPs changes, therefore it is important that SOPs published at this web location be consulted when referencing LRPCD SOPs.

The tasks and subtasks in this contract action identify QAPPs which will or may require revision. QAPP revisions must be reviewed and approved by the LRPCD QA manager before research begins under this work assignment.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-18

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X To Option Period Number	Research Support in the Area o

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	Section 4 (B) and (C)

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

Period of Performance: From 09/30/2015 To 09/29/2016

Comments:
The contractor shall immediately start work on all tasks listed in the Work Assignment Performance Work Statement.

☐ 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 (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: To — 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 Souhail Al-Abed	(Signature)	(Date)	Branch/Mail Code: Phone Number 513-569-7849 FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-569-7196 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
CONTRACT NO. EP-C-15-010

WORK ASSIGMENT 0-18

IMMEDIATE START

Research Support in the Areas of Mining and Contaminated Sites Management

SHC Task# 3.62 and 3.63

WORK ASSIGNMENT CONTRACTING OFFICER'S REPRENSENTATIVE:
SOUHAIL AL-ABED
513-569-7849
AL-ABED.SOUHAIL@EPA.GOV

ALT WACOR:
JOHN MCKERNAN
513-569-7415
MCKERNAN.JOHN@EPA.GOV

PERIOD OF PERFORMANCE: Sept. 30, 2015 through Sept. 29 2016

LOCATION: On-site

1. Background

Task A: Evaluation of Mine-Influenced Water Treatment Technologies

Run-off and drainage from active and inactive mines are some of the most environmentally damaging land uses in the United States. Mine impacted water (MIW) is emanated from these mine sites and typically contains elevated levels of toxic heavy metals, which can adversely impact the environment. The major pathway involved in generation of MIW is weathering of pyritic mineral ores, where sulfur is oxidized to sulfate followed by the release of metallic ions. Due to the low pH of the MIW, these metallic ions are kept in the dissolved phase and are, therefore, highly active and mobile. Increased awareness of heavy metal toxicity and of the extent of surface water, ecosystems, and soil contamination throughout the country have stimulated the regulators to investigate effective treatments to remove heavy metals from MIW. In recent years, passive remediation systems have gained popularity due to their lower cost, low required maintenance, and because of the reduced amounts of generated hazardous waste. Passive remediation using sulfate reducing bioreactors (SRBRs) has received significant attention as a promising approach to MIW treatment. Among the several cultures that are used in the bioreactors, Sulfate Reducing Bacteria (SRB), offer the advantages of high metal

removal, even at lower pH than other treatments, and very low operational costs. The main mechanism by which SRB perform metal removal is the reduction of sulfate species to sulfides using carbon sources as the electron donors. Upon sulfate reduction, metal precipitation and coprecipitation occur via the formation of metal sulfides, hydroxides, and carbonates.
In most bioreactors, the SRB sources are the consortia existing at the remediation site. Sometimes, the addition of external inocula is needed, and these could come from sediment, manure, or other sources. Recently, the addition of crab shell (chitin) products as a carbon source for SRBs has gained attention in MIW treatment. Chitin contains about 6-7% of nitrogen and 21% of carbon, making it a nearly ideal carbon-nitrogen ratio for bacterial growth. Also, several chitin products have been successfully used as a physical metal sorbent. A particular advantage of the chitin products is their ability to retain permeability during degradation, making it an excellent substrate for MIW remediation. The idea is to use chitin products in field-scale bioreactors to take full advantage of their composition: the protein should be a carbon source for the biomass, the calcium carbonate will provide alkalinity to increase the MIW pH, and the chitin polymer will be a good substrate for the biomass, while the SRBs act reducing sulfates to sulfides and precipitating the target metals as sulfide salts. In several cases, the MIW needs to be treated to reach surface water quality criteria which may exceed the capabilities of traditional treatments, and the use of new substrates, like chitin, could help to improve the effluent quality in these cases.

With the purpose of evaluating metal removal efficiency, effluent water quality and the typical operational parameters used in the bioreactors design using chitin as substrate, it is important to:

i) Evaluate metal removal from MIW in bioreactors using the chitin product (SC-20) as substrate in anaerobic column reactors and in pilot-scale trench reactors, both running at different hydraulic retention times.
ii) Compare metal removal efficiency of the SC-20-containing reactors that utilize other types of substrate: wood chips, hay, manure, limestone, etc.
iii) Investigate the involved mechanisms in metal removal under anaerobic conditions.
iv) Compare metal removal rates with an abiotic system with similar characteristics.
v) Study the hydraulics of trench reactors.

The contractor shall perform bench scale (column studies) evaluations using substrates and MIW sources to determine metal removal efficiency and to study mechanisms involved with the MIW remediation with each type of substrate. Also, a pilot-scale trench reactor shall be used to determine the hydraulic parameters using chitin as substrate.

Considering that past publications and experiences accrued by the EPA regarding MIW treatment along with other related research from available literature, the contractor shall compile a "Mine Impacted Water Treatment Manual" which will aim to benefit those involved in the decision making process for MIW treatment. This manual will ultimately

be used to create a web-based decision tool that will service the mining industry, environmental consulting firms, local, state, and national regulatory and monitory agencies, the academic community, and all those interested in MIW treatment. The manual should be submitted to the EPA WACOR by August 1, 2016.

In addition, the contractor shall complete analyses of samples from Engineering Technical Support Center (ETSC) field projects. These analyses could be used to compare different studies and to obtain conclusions about the effectiveness of different alternative techniques used for MIW treatment.

The contractor shall deliver all analyses in Excel spreadsheets for analytical data, and for reports, MS WORD.

TASK B: Bench and Analytical Research Support in the Area of Sustainable Materials Management

A thorough examination of well-established and emerging waste management methods is warranted to facilitate decision-making for treatment, disposal, reuse, and recycling of waste considering the three pillars of sustainability: environmental, social, and economic impact.

The burning of coal in electric utility boilers and power plants generates residual materials—mainly fly ash, bottom ash and flue gas desulphurization (FGD) scrubbers. These residual materials are collectively called as Coal Combustion Residues (CCRs) or Coal Combustion Products (CCPs). Almost 70% of the total CCRs generated is land-disposed while the rest are used for beneficial applications such as wallboard and cement. The beneficial use of CCRs and the economic gains associated, has spurred interest in the reuse of these wastes[1, 2]. One of the interesting beneficial use scenarios for CCRs is agricultural soil amendment, which adds alkalinity to the soil and provides a soil matrix for metal immobilization.

In CCRs beneficial use, metals such as mercury, cadmium, selenium, chromium, lead, and arsenic may be released to the environment and potentially cause serious health effects. EPA's risk assessment and damage cases demonstrate that, without proper protections, these contaminants can leach into groundwater and migrate to drinking water sources, posing significant health public concerns. Furthermore, EPA supports environmentally responsible beneficial use of CCR and other byproducts to reduce the amount of landfilled CCR, conserve resources, reduce greenhouse gas emissions, lessen the need for waste disposal units, and provide significant domestic economic benefits.

2. Prepare / Modify Health and Safety Plan (HASP)

An existing HASP will be provided by the EPA WACOR and followed by all laboratory personnel, including contractor personnel. Modification of the HASP shall be done as needed, and when required by the WACOR via written technical direction.

3. Prepare/ Modify Quality Assurance Project Plan (QAPP)

QA-Level: (3)

The contractor shall amend the existing QAPP as needed, and when the WAM requires it via written technical direction. The existing QAPPs are:

1) The QAPP QAID # L-10544-QP-1-2 entitled "Column Studies for Acid Mine Drainage Treatment using Chitin Products" approved by Mr. Jim Voit on 4/14/2014.
2) The QAPP QAID # L-20963-QP-1-3 entitled "Carpenter Snow Creek Mining District Water Anaerobic Bioremediation using Local Substrates" approved by Mr. Jim Voit on 7/16/2015.
3) The QAPP entitled "Pilot-Scale studies on mine impacted water treatment using chitin products" was approved by Mr. Jim Voit on 03/04/2015. QAPP L-19444-QP-1-2 entitled "Leachibility of Metals from FGD Gypsum used in Agricultural Purpose" was approved on 11/14/2013 by the QA officer, and is currently in use.
4) QAPP L-0009-QP-1 entitled "Use of FGD gypsum to immobilize/remove heavy metals in contaminated soils and water" has been written and is under QA review.
5) QAPP L-19809-QP-1-2 "Field Sampling Plan for Flow Measurement and Water Quality Collection in the Spring River Watershed" approved by Mr. Jim Voit on 8/25/2015.

4. Work / Experimental Requirements

The contractor shall perform the following tasks:

i) Perform column bioreactor studies to evaluate different substrates using commercial and non-commercial materials (chitin products, wood chips, hay, manure, etc) for metal removal from MIW. Details of these experiments are documented in the existing QAPPs. The objectives of the column studies are:

- To evaluate the metal removal efficiency from MIW under anaerobic conditions using different types of materials as substrate.
- To investigate the involved mechanisms in metal removal under anaerobic conditions.

ii) A pilot-scale trench reactor shall be utilized to treat MIW to study metal removal and important operational hydraulic parameters. The specific objectives are the following:

- To obtain hydraulic parameters using chitin as a susbstrate: substrate permeability, hydraulic dead space at different hydraulic retention times (HRTs).
- To evaluate metal removal at different HRTs.
- To determine residence time distribution in the trench reactor.

iii) Perform bench-scale leaching tests:

- Generalized acid neutralization capacity (GANC)
- Toxicity characteristic leaching procedure (TCLP)
- Synthetic precipitation leaching procedure (SPLP)
- Other batch tests, availability tests
- Constant pH tests and redox tests
- Column tests
- LEAF methods (1313, 1314, 1315, 1316)
- Density separation techniques to evaluate the beneficial reuse of various waste materials such as fly ash, bottom ash, flue gas desulfurization (FGD) scrubber, natural gypsum, mining waste, HF waste, foundry sand, contaminated sediments and others.

iv) Perform speciation and characterization of solid samples and residues from adsorption experiments, column and pilot-scale studies. The analytical work would include, but is not limited to:

- Total metals by acid digestion and as specified in EPA Method 6010B (ICP-AES)
- XRD crystallography
- Scanning electron microscopy (SEM)
- Transmission electron microscopy (TEM)
- Fourier Transform Infra-Red (FTIR) spectroscopy
- X-ray photoelectron spectroscopy (XPS)
- Total organic carbon
- Solid pH

v) Characterize aqueous and solid samples from MIW treatment and watershed contaminants migration field studies.

vi) Perform evaluations of the sustainability of mining practices, beneficial use of materials, harmonization of the environmental requirements for beneficial use, or other evaluations on sustainability as directed by the WACOR.

vii) Because field studies are conducted in several locations both in the U.S. and Europe, the contractor will communicate with external collaborators (e.g. Regions 3 & 4, Office of Water personnel) through the WACOR by teleconference, e-mail, fax machines, or video conferences.

5. Progress Meetings

An overall project and work effort planning meeting shall be held within 10 days of the WA period of performance start date. Weekly progress meetings shall be held with the EPA WACOR. Technical directions and any clarifications to the experiments may be discussed during the weekly progress meetings.

6. Travel

All travel must be approved by the Project Officer in accordance with the contract clause.

The contractor personnel shall travel at the request of the EPA WAM via written technical direction to mine sites and other research facilities (universities and national laboratories, or to certain locations as needed to accomplish the expressed objectives). The number of trips should not exceed 3. All locations will be within 500 miles of Cincinnati.

The contractor may need to attend national conferences not to exceed 2 events to present research related to this WA in forms of presentations, seminars, or posters. Each conference shall not exceed 5 days. The EPA WACOR will issue written technical direction to specify the conference and location.

7. Expected Outputs

i) The contractor shall provide experimental data in spreadsheets format (MS EXCEL), include QA parameters and the analytical procedures followed by the contractor in Word, and provide laboratory notebooks formatted according to SOP # 16 (previously provided by the WACOR under EPC11006, WA 4-18).

ii) The contractor shall participate in meetings with the WACOR and in certain occasions with the ETSC director. The contractor shall not respond nor provide information, nor undertake any process which can be deemed an inherently governmental function.

iii) A draft manuscript on the evaluation of a trench reactor hydraulics shall be due on August 1, 2016.

iv) The contractor shall provide a draft manuscript on the Use of Flue Gas Desulfurization Gypsum for In-Situ Pb Stabilization in Contaminated Soil by August, 1 2016.

v) The contractor shall purchase consumables as necessary. All consumables shall be approved by the WACOR and the Contract Level COR prior to placing the order.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-18

☐ Other ☒ Amendment Number: 000002

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	09/30/2015 To 09/29/2016 Base X Option Period Number	Support in Mining Research

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	Sections 4 (B) and (C)

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

Period of Performance: From 09/30/2015 To 09/29/2016

Comments:
The purpose of this amendment is to add the language below as a new Task, Task C. All other tasks and outputs remain the same.

☐ 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: 09/30/2015 To 09/29/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Souhail Al-Abed	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7849 FAX Number:
Project Officer Name Michael Moeykens	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7196 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

Contract No. EP-C-15-010

WA 0-18, Amendment 1

Title: **Evaluation of Remediation Technologies of Contaminated Water and Soils and their Sustainability**

Work Assignment Manager (WAM):

Souhail Al-Abed

Waste Management Branch

Land Remediation and Pollution Control Division

U.S. EPA National Risk Management Research Laboratory

Cincinnati, Ohio 45268

Phone: 513-569-7849

Project Period: **CO Issuance through 9/29/16**

Purpose:

The purpose of this amendment is to add the language below as a new Task, Task C. All other tasks and outputs remain the same.

TASK C: Evaluation of Remediation Technologies of Contaminated Water and Soils and their Sustainability

A number of established and novel technologies are currently available to remove, reduce, or stabilize organic and inorganic contaminants from aqueous phase matrices (e.g. mine impacted water, industrial wastewater, municipal solid waste landfill leachate, groundwater, etc.) and solid matrices (e.g. contaminated soil, contaminated sediments, industrial byproducts, etc.) whose effectiveness, mechanisms, and sustainability need to be thoroughly studied to establish guidelines for their development and application. This task also contributes with the development and standardization of the tools used for such evaluations.

Recognizing that sustainability is pivotal for the Agency's mission, the evaluation of the novel and established selected technologies using measured parameters and indicators, including sustainability matrices, enhances the evaluations not limiting them to environmental impact, but also adding economic and social impact of the technology applications.

Subtask C1: Evaluation of Remediation Technologies for Aqueous Phase Contaminants

Treatment technologies that remove organic and inorganic contaminants from aqueous phase are to be evaluated from the point of view of quantification of contaminants removal, treatment energy and materials efficiency, chemical and physical principles applied, cost, and intended further use of the water. Several of these technologies have been already studied onsite and the mechanisms have been identified, but need further evaluations to be fully understood; while others need the determination of main interactions and mechanisms that govern their applications. Among the technologies that could be evaluated are: adsorption, bioremediation, electrochemical degradation, precipitation, membrane filtration and others applicable to metals, other inorganic contaminants, or organic contaminants.

The aqueous matrices that considered for studying are:

- Mine impacted water: water that is emanated from operational or abandoned mine sites that is generated by runoff and is affecting nearby surface water sources, ecosystems, and communities.
- Industrial wastewater: water used in industrial operations that needs to be disposed or reused, but needs to be treated to comply with regulations or reuse characteristics.
- Municipal solid waste landfill leachate: the water that is generated in a municipal solid waste landfill and could be affecting surface or groundwater because its contaminants content and characteristics.
- Other aqueous phases that could impact surface water or ground water quality.

Subtask C2: Evaluation of Remediation Technologies for Solid Phase Contaminants

Treatment technologies to remove contaminants from soils, sediments, and other solid matrices need to be evaluated to determine the effectiveness of contaminants removal and the removal mechanisms. Also, in a number of technologies, the contaminants are not to be removed, but solidified or stabilized. These technologies are also to be investigated considering effectiveness and mechanisms. In evaluating the effectiveness of stabilization, the use of leaching tests is often required. These leaching tests can also be performed in cases in which the stabilized soil is to be evaluated for beneficial use. The principles of sustainability are also to be applied in these evaluations, including environmental, economic and social impact of their applications.

Among the solid phases that could be evaluated are:

- Industrial contaminated soils: soils left on industrial sites and have been found contaminants laden, or moved to other sites to be disposed, but found to contain contaminants above environmentally safe levels.
- Contaminated sediments: found in rivers, lakes, canals, and other water bodies could be affected by industrial contaminants and need to be cleaned up to remediate the water body.
- Other solid matrices: these could be a mix of soils and industrial materials that need to be evaluated for contaminants stabilization or beneficial use.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-20

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	To	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X	Option Period Number	Water Utility Lime Reuse

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	Section A3, B2, E2, and H1,2,3,7,11,12

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

Period of Performance: From 12/01/2015 To 09/29/2016

Comments:
The contractor is authorized to start work on all PWS tasks at work assignment issuance.

☐ 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 (Max 7)
1										
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Authorized Work Assignment Ceiling

Contract Period: To — 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 Craig Patterson	(Signature)	(Date)	Branch/Mail Code:
			Phone Number 513-487-2805
			FAX Number: 513-569-7052
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7196
			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
EPA Contract No.: EP-C-15-010
Work Assignment: 0-20

TITLE: Water Utility Lime Reuse in Power Utilities

WORK ASSIGNMENT CONTRACTING OFFICER'S REPRESENTATIVE (WACOR):
Craig L. Patterson
USEPAORD/NRMRL/WSWRD/WQMB
26 W. Martin Luther King Drive
Cincinnati, Ohio 45268
(513) 487-2805 / E-mail: Patterson.Craig@epa.gov

ALTERNATE WACOR:
Jeff Adams
USEPAORD/NRMRL/WSWRD/WQMB
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(513) 569-7835 / E-mail: Adams.Jeff@epa.gov

PERIOD OF PERFORMANCE: CO Issuance to September 29, 2016

BACKGROUND:

There are hundreds of water utilities across the U.S. that generate significant amounts of lime sludge as a result of the water softening process. For instance, a water treatment plant in the Midwest serving 350,000 people generates 60,000 tons of lime sludge per year. Locally, the Bolton Treatment Plant in Fairfield, OH uses lime softening to treat 15 MGD of groundwater. Generated lime sludge is currently managed by disposal in landfills that adds up to 10% to the overall cost of water treatment. Beneficial use of the limestone sludge will eliminate the disposal cost and could potentially generate income for water utilities.

According to the U.S. Energy Information Administration, 60% of coal-fired power generation capacity belongs to the plants equipped with SO2 scrubbers. In the scrubbing process, in the majority of the coal-fired utilities, limestone is ground to < 325-mesh size then reacted with the flue gas to capture SOx and produce a gypsum byproduct. Transportation and preparation of limestone is an energy-intensive process, has a high CO_2 footprint, and requires a significant cost particularly if a high quality limestone is not available locally and needs to be transported over long distances. Several recent studies by researchers in Illinois, Iowa and Kansas have demonstrated that lime softening sludge can perform very well in removing SOx from flue gas. These studies showed that a majority of collected lime sludge samples had a good purity (>80% $CaCO_3$) and excellent reactivity resulting from their small particle size (e.g., ~10 μm vs. ~30 μm for the limestone powder) and high surface area (e.g., 5-15 m2/g vs. < 2 m2/g for the limestone powder). Replacement of limestone with the lime sludge that is preferably available from the local water utilities can benefit the power utilities by: 1) eliminating the cost of high quality limestone transportation over the long distances; 2) eliminating the energy-intensive grinding stage of limestone preparation; and 3) reducing the overall CO_2 footprint.

A majority of lime softening sludge samples contain significant amounts of Natural Organic Matter (NOM) and some sludge samples may contain residual powdered activated carbon (PAC) used in the water treatment process. Both NOM and PAC can adsorb heavy metals such as

Mercury (Hg) and Selenium (Se). Control of mercury and other heavy metals is a major challenge for the coal-fired utilities. Particularly, many power utilities equipped with wet scrubbers are required to add special additives to the limestone slurries to sequester mercury and prevent its re-emission. Locally, Zimmer Generating Station in Moscow, OH emitted 127 pounds of airborne mercury pollution in 2010. Replacement of limestone with lime sludge can potentially control the mercury re-emission and lower emissions of other heavy metals (e.g. Se) at no additional cost.

TECHNICAL APPROACH:

The goal of this study is to evaluate the feasibility of a sustainable and transformative approach for reuse of lime softening sludge, generated from drinking water treatment utilities, as an environmental sorbent for capturing SOx and heavy metals in wet scrubbers of coal-fired power plants. The contractor shall provide the following support:

Task 1 – Prepare quality assurance and health and safety project plans
Task 2 – Provide a literature review
Task 3 – Provide a techno-economic analysis
Task 4 – Conduct a study on the effectiveness of lime sludge for SOx and Hg removal
Task 5 – Prepare a summary report

WORK ASSIGNMENT TASKS:

Task #1: Prepare quality assurance and health and safety project plans

The contractor shall prepare a quality assurance project plan (QAPP) and health and safety project plan (HASP) to reflect research study efforts.

Task #3: Provide a literature review

The contractor shall prepare a literature review that provides background research on existing similar methods, identifies potential limitations of these methods and proposes technical solutions that this new approach will incorporate.

Task #4: Provide a techno-economic analysis

The contractor shall prepare a techno-economic analysis to estimate the overall benefits for water/power utilities in the U.S. The techno-economic analysis shall include an energy and CO_2 footprint analysis of replacing limestone with the lime sludge.

Task #5: Conduct a study on the effectiveness of lime sludge for SOx and Hg removal

The contractor shall fabricate appropriate bench-scale test apparatus. The contractor shall prepare an experimental plan for a research study using the test apparatus based on the EPA-endorsed QAPP. The contractor shall evaluate the effectiveness of selected lime sludge samples for simultaneous SOx removal and mercury control and document research findings.

Task #6: Prepare a summary report

Results and highlights of Tasks 3, 4 and 5 shall be summarized and compiled into a Draft Summary Report on or before March 4, 2016. After addressing the WACOR's comments, the contractor shall provide a Summary Report by March 25, 2016. The contractor shall provide all Work Assignment deliverables in both PDF and the original source format (e.g., Microsoft Word, Powerpoint, Excel).

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-22

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	To	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X	Option Period Number	Small Systems Drinking Water T

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	4.c

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

Period of Performance: From 10/01/2015 To 09/30/2016

Comments:
The contractor shall immediately start work on all tasks listed in the Work Assignment Performance Work Statement.

☐ 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 (Max 7)
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Authorized Work Assignment Ceiling

Contract Period: To — 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 Darren Lytle	(Signature)	(Date)	Branch/Mail Code:
			Phone Number 513-569-7432
			FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7196
			FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code:
			Phone Number:
			FAX Number:
Contracting Official Name Candice Charlton	Candice Charlton (Signature)	10/02/2015 (Date)	Branch/Mail Code:
			Phone Number: 513-487-2007
			FAX Number:

Performance Work Statement
Contract No. EP-C-15-010
WA 0-22

Small Systems Drinking Water Treatment and Distribution Studies

Work Assignment Contracting Officer's Representative (WACOR):
Darren Lytle
513-569-7432
Lytle.darren@epa.gov

Alternate WACOR: **Sam Hayes**
513-569-7514
Hayes.sam@epa.gov

Period of Performance: **CO Issuance through 09/29/16**

Location: **On-site**

TASK A

1. Project Background

In the U.S., approximately 94% of drinking water systems are considered small systems. A drinking water treatment and distribution system is considered small by EPA if it serves 3,300 or fewer customers. While many of the 143,299 active small systems consistently provide safe, reliable drinking water to their customers, many face a number of challenges in their ability to achieve and maintain system sustainability. Some of these small system challenges include aging infrastructure, increased regulatory requirements, workforce shortages and high-turnover, lack of expertise, increasing costs, and declining rate bases. While there is an immediate need to address regulated drinking water contaminants of concern now, there exists a need to consider near future challenges and take new technologies to the next stage of development. For example, emerging contaminants of concern, fluoride, strontium, algal toxins and others must be considered as well as new treatment approaches or treatment modifications.

The tasks of this work assignment will be carried out by performing bench-scale and pilot-scale studies to demonstrate the removal of emerging contaminants of concern such as fluoride, strontium pesticides, and other compounds. Distribution system issues including lead and copper, and nitrification (nitrate and nitrite) will also be considered. In addition microbial contaminants of concern will be considered.

This work assignment will utilize contractor personnel to: (1) maintain and operate current and potentially new bench and pilot scale studies, (2) conduct simple chemical analyses (e.g., pH, DO, temperature, etc.) and document materials surfaces in a simple way (e.g., photographs, simple microscopy) for these studies in accordance with existing sample preparation and analysis protocols; and (3) make and document simple

modifications to those protocols if necessary. These studies will be conducted at WSWRD using division equipment and experimental.

2. APPROACH

(a) Health and Safety Plan

WSWRD currently has a general laboratory operational safety plan, which is applicable to assure safe conduct of sample preparation and analysis using WSWRD instruments. The work assignment manager will provide the Safety Plan to the contractor. The contractor shall read and understand the Safety Plan before studies are begun. As needed, the EPAWACOR may review the Safety Plan, make approved revisions, and explain the revised Plan to the contractor. The Contractor is free to comment on the existing Safety Plan.

(b) Basic Research Quality Assurance Project Plan (QAPP)

Quality Assurance Project Plan (QAPP) is in place, covering all instrumentation used in this project. The QAPP describes protocols for sample analyses, methodology for sample preparation, and standardizations. The QAPP refers to relevant WSWRD SOPs. The EPA WACOR will provide the QAPP and SOPs to the contractor. The contractor shall read and understand the QAPP and SOPs before the studies begin. Also, other studies may have specific quality assurance needs that will require a separate QAPP. This will be study specific and will be provided to the contractor. As needed, the EPA WACOR may review the current QAPP and SOPs and make approved revisions. The contractor may be required to offer input into the formation or revision of any QAPP or SOP, but will not be responsible for formally making the revisions.

QA-Level: Sampling and Analysis, Category 3 = Applied Research

Applicable QAPPs include:

W-17110-QP-1-0; W-16794-QP-1-0; W-17110-QP-1-0

QAPPs for specific future studies will be developed by the EPA WACOR prior to project initiation as needed.

(c) Work / Experimental Requirements

(1) The contractor shall maintain and operate current and potentially new bench and pilot scale water treatment and distribution studies which may include the operation of water treatment pilot plants to achieved desired test waters. It is anticipated that two experimental systems will be in operation at a time. The contractor shall use protocols, SOPs, a Quality Assurance Plan, a Safety Plan, logbook formats, data sheet formats, computerized software, and sample label formats provided by the EPA WACOR. All supplies, pilot and bench test systems, equipment and instrumentation will be provided by WSWRD. Study

activity shall include: (a) logging in of samples; (b) proper clean up; (c) literature searches; and (d) conduct simple bench-scale or laboratory experiments to test the solubility limits of metals (e.g., copper, lead, iron, strontium, phosphate) under drinking water conditions. Samples will be available on the PoP start date.(2) The EPA WACOR will train the contractor on all aspects of the protocols, SOPs, location and storage of reagents, sample preparation, and operation of instruments and pilot and bench-scale systems. The EPA WACOR will again train the contractor upon the addition of, or revisions to protocols, SOPs, software, or instruments. Additions or revisions may result from the EPA WACOR's review of the results of these studies. Studies will commence when the EPA WACOR and the contractor agree that, as a result of training, the contractor is skilled in the requirements of the protocols, SOPs, instrumentation, etc.

(3) The contractor shall assign sample IDs as samples are received by WSWRD and/or to samples sent to other labs for additional analyses.

(4) The contractor and the EPA WACOR will agree on the dates and times of all studies. The number of studies shall not exceed 4.

(5) In the conduct of these studies, the contractor shall fill out logbooks and data sheets in formats provided by the EPA WACOR. Data sheets will be fill-in-the-blank types and electronic spreadsheets. Logbooks will record date, time, and describe studies conducted, observations, cross-references to data sheets and electronic spreadsheets and sample labels, etc. Logbooks will also record all problems, or by the contractor with the approval of the EPA WACOR. A review of weekly project status and outcomes shall be made to the EPA WACOR on a weekly basis. Electronic data file updates (excel, etc) shall also be provided weekly or as available.

(6) The contractor shall prepare reports (not to exceed 20) for samples and water systems as indicated by the EPA WACOR via written technical direction, which combine analytical data from all different procedures performed on the samples by EPA and the contractor, and which will include evaluation of data quality based on application of various QA protocols, such as analysis of Standard Reference Materials. When appropriate, the contractor shall prepare or contribute to preparing short technical journal manuscripts (1-2) in scientific collaboration with EPA. The manuscript shall report the results of contractor experimental and analytical studies performed under this WA.

(d) Progress Meetings

The contractor shall participate in informal meetings with the EPA WACOR to review the progress of the studies, and to discuss problems with the sample preparation or analysis activities. If appropriate, other EPA staff may attend these meetings at the request of the WACOR. Examples would include WSWRD's QA Officer and a

representative of AWBERCs Safety Office. These meetings will occur at the AWBERC every week on dates and times agreed upon by the contractor and the WACOR.

3. Expected Outputs

(1) The contractor shall assure the EPA WACOR that appropriate contractor staff have read and understood the Safety Plan. If needed, appropriate members of the contractor staff will sign the Safety Plan.

(2) The contractor shall assure the EPA WACOR that appropriate contractor staff have read and understood the Quality Assurance Plan and the SOPs. As needed, appropriate members of the contractor staff will sign the Quality Assurance Plan.

(3) The contractor shall complete logbooks, computerized forms, and data sheets in the formats indicated by the EPA WACOR via written technical direction. Log books, analytical instrument output electronic files and data sheets shall be presented to the EPA WACOR (a) on a bi-weekly basis (b) at the completion of each stage of sample preparation and analysis (c) whenever samples are to be shipped, or (d) whenever the contractor, using his/her discretion, had deviated from the protocols, SOPs, Safety Plan, Quality Assurance Plan or reporting formats. Completion of log books, instrument analytical output files and data sheets indicates that, in the conduct of the studies, all requisite pipe scale samples have been collected, prepared and analyzed according to protocols and SOPs.

TASK B – TECHNICAL COMMUNICATIONS AND DATA MANAGEMENT FOR DRINKING WATER RESEARCH

1. INTRODUCTION AND BACKGROUND

This research program focuses on communicating results from research on the treatment and distribution of drinking water, water resources and other water-related topics. There are many areas of research being conducted by the USEPA. For instance, with regard to treatment, the Water Supply and Water Resources Division (WSWRD) is conducting work on the removal of algal toxins, and pesticides from drinking waters, as well as work on distribution systems. The objective of this work assignment task is to communicate results and activities performed in WSWRD and associated with various Research Action Plans (RAPs) including SSWR.

The technical capabilities of WSWRD, USEPA are sought to assist water utilities, their consultants, state regulators, and EPA Regional Offices in helping water systems achieve regulatory compliance and protect public health by enabling them to make changes to their water qualities without or minimizing the degree of excess of regulated maximum contaminant levels and adverse aesthetic impacts, and provide appropriate source water protection actions. In order to achieve these goals, research samples need to be tracked and the associated outputs must be compiled and synthesized into reports and

summaries that serve two purposes: (1) to record the analytical methods, procedures, results and interpretations for reference and inclusions in research reports and journal papers; and (2) to package the information in a clear and readable manner in many formats for reporting to the "clients" of the research work, i.e. the NPD office, programs offices, laboratory, regions, water systems, consultants, states regulators, and others. Data gathered during the WSWRD research needs to be summarized, developed and packaged for dissemination to "clients" as technical manuscripts, EPA reports, web sites, conference presentations, or other similar output products

2. APPROACH

(a). Prepare / Update Health and Safety Plan (HASP)

Though most of this work will be in an office setting, some data and information-gathering and processing may take place in analytical laboratories. WSWRD currently has a general laboratory operational safety plan, which is applicable to assure safe conduct of sample preparation and analysis for pipes using WSWRD instruments. The Work Assignment Manager (WACOR) will explain the Safety Plan to the contractor, and will discuss what is applicable to this project. The contractor will read and understand the Safety Plan before studies are begun. As needed, the WACOR may review the Safety Plan, make approved revisions, and explain the revised Plan to the contractor. The Contractor is free to comment on the existing Safety Plan.

(b). Quality Assurance Project Plan (QAPP)

A Quality Assurance Project Plan (QAPP) prepared by WSWRD will be in place for all projects for which data will be processed, analyzed and assembled for reports and manuscripts. This will serve as a resource for documentation and guidance for the contractor. The QAPPs will describe protocols for sample analyses, methodology for sample preparation and standardizations, and general data manipulation and analysis approaches. The QAPPs will refer to relevant WSWRD SOPs. The WACOR will explain the QAPPs and SOPs to the contractor. The contractor will read and understand the QAPPs and SOPs before studies begin. As needed, the WACOR may review the QAPPs and SOPs, and explain any revised QAPPs and SOPs to the contractor. Depending upon the results of the research, additional outputs and different audiences may be desired, than those described in the original QAPPs. In such cases, the contractor shall make relevant modifications to the QAPPs and SOPs to accurately reflect the changes in output activity.

(c). Work/ Experimental Requirements

The contractor shall assist with the processing and dissemination of research results and studies on the treatment and distribution of drinking water, source water protection and other research topics covered in the WSWRD. The contractor shall use protocols, SOPs, QAPPs, a Safety Plan, logbook formats, data sheet formats, computerized software, and sample label formats provided by the EPA WACOR. All computer equipment will be provided by WSWRD. Certain computer software

associated with communication and outreach material development will be provided by WACOR. Study activity under these protocols will include:

(1) logging in and tracking of samples for which analytical reports will be generated.

(2) Taking research information in the form of electronic word processor files, spreadsheets, photographs, jpg image files, ascii text files, and the like, provided by the EPA WACOR and combining and editing the information into formats suitable for reports, presentations and other communication formats to be provided to the program office, NPDs, water systems, engineering firms, or other clients, or for manuscripts to be sent to conferences or to technical journals. The development of draft papers and reports shall use software such as Word, Photoshop, SigmaPlot, Excel, PowerPoint, Origin, EndNote, Adobe Acrobat, SigmaStat, and any other appropriate graphical, word processing, image manipulation, publication or presentation software agreed upon by the contractor and WACOR.

(3) The contractor shall electronically lay out the reports or manuscripts in accordance with templates and formatting requirement information provided by the WACOR or by the publishers of the journals, conference proceedings, or reports using Word, PowerPoint, or other software agreed upon by the contractor and the WACOR.

(4) When appropriate, the contractor shall assist in the development of the reports, presentations, or manuscripts by conducting suitable literature reviews and gathering reference materials from textbooks, journals, libraries, the Internet, or from other researchers, or summarizing from WSWRD technical documents.

(5) The contractor shall assist in the development of the reports, presentations, or manuscripts by arranging and summarizing data into graphs, tables, or figures, using software compatible with that used by the technical and communications staff of WSWRD.

(6) The contractor shall perform simple statistical and graphical summaries of experimental data using software, such as mean, median, sum, line graphs or bar charts.

(7) Outreach, material, and other communication products developed by the contractor shall be done so according to EPA and WSWRD communication policies and standards where applicable. WSWRD's technical communications officer shall be a source for such information.

3. OUTPUTS

The contractor shall participate in informal meetings with the EPA WACOR to review the progress of the reports, manuscripts and summaries. If appropriate, other EPA staff may attend these meetings at the request of the WACOR. Examples would include WSWRDs QA Officer or other EPA researchers that are associated with the project.

These meetings will occur at the AWBERC on dates and times agreed upon by the WACOR and the contractor.

(1) The contractor shall assure the WACOR that appropriate contract staff have read and understood the Safety Plan. If needed, appropriate members of the contractor staff will sign the Safety Plan.

(2) The contractor shall assure the WACOR that appropriate contractor staff have read and understood the Quality Assurance Plan and the SOPs. If needed, appropriate members of the contractor staff will sign the Quality Assurance Plan.

(3) The contractor shall complete the draft reports, manuscripts, presentations, etc. in the formats recommended by the EPA WACOR via written technical direction. Log books, electronic files, and data and work sheets will be available to the WACOR at the completion of each stage of writing, and transferred to the WACOR at the completion of a given project.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-27

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	To	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X	Option Period Number	Watershed Health Estimation

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	4(G); GIS and modeling support

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

Period of Performance: From 11/05/2015 To 09/29/2016

Comments:
The contractor shall immediately start work on all tasks listed in the Work Assignment Performance Work Statement.

☐ 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 (Max 7)
1										
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Authorized Work Assignment Ceiling

Contract Period: To — 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 Mohamed Hantush	(Signature)	(Date)	Branch/Mail Code:
			Phone Number 513-569-7089
			FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7196
			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:

CONTRACT EP-C-15-010
Work Assignment 0-27
Performance Work Statement

Decision Support Tool for Risk-Based Watershed Health Estimation

Work Assignment Contracting Officer's Representative (WACOR):
Mohamed Hantush 513-569-7089

Alt. WACOR:
Stephen Wright 513-569-7610

Period of Performance: CO Issuance to September 29, 2016

The National Risk Management Research Laboratory (NRMRL) is the principal entity within U.S. EPA and the Office of Research and Development (ORD) responsible for environmental and engineering risk management research. Development of approaches, modeling tools, and application thereof, to the management of water quality and ecosystems in multiple land-use watersheds under a changing climate and at multiple scales, is one critical research area. This research contract lends assistance to research on sustainable water resources management conducted by the Environmental Stressors Management Branch (ESMB), Land Remediation and Pollution Control Divisions and National Risk Management Research Laboratory (NRMRL), Office of Research and Development (ORD), United States Environmental Protection Agency (U.S. EPA).

Background:

Risk-based indicators such as reliability, resilience and vulnerability (R-R-V) have been applied in numerous studies to indicate the health of water resources systems such as reservoirs (Kjeldsen and Rosbjerg, 2004). However, the application of R-R-V to watershed health as it relates to non point source pollution (NPS) is an area where little to no work has been done (Hoque et al., 2012, 2013, and 2014). This work assignment emphasizes the application and improvement of a decision support framework for estimating revised R-R-V indicators and new composite watershed health measure using flow and water quality time series observed at monitoring gauge stations.

Scope of Work:

This work assignment shall provide research services to the U.S. EPA at the Cincinnati research facility using the risk-based decision support framework (DST) developed under EPC11006, WA 4-27 for the Upper Mississippi River Watershed, the Maumee River Basin, and the Ohio River Basin. The primary focus is on application of the modified R-

R-V and composite watershed health (WH) metrics and developing regression models relating risk indices to watershed attributes and long-term hydro-climate variables.

Objectives:

This work assignment aims at achieving the following objectives:

1. Conduct trend analysis and investigate scale-dependency of a newly developed composite WH measure in the Upper Mississippi River Watershed, the Maumee River Basin, and the Ohio River Basin.

2. Conduct risk-assessment at the watershed level and to predict WH of critical source areas as a function watershed attributes and annually-averaged climate variables.

Task 1: Application of revised R-R-V analysis

The contractor shall apply the risk-based decision support framework (DST) developed under EPC11006, WA 4-27 and the revised Reliability, Resiliency, and Vulnerability (R-R-V) metrics, including the new composite watershed health measure (WH), to conduct trend analysis of R-R-V and WH at specific locations in the Upper Mississippi River Watershed, the Maumee River Basin, and the Ohio River Basin. The contractor shall explore scale dependency as a function of drainage density of WH measure in the Saint Joseph River Watershed (SJRW).

The contractor shall submit within 6 weeks of the WA period of performance start date, a revised version of the QA Project Plan (QAPP) previously developed under EPC11006, WA 4-27, (L-20978-QP-1-1, Decision Support Tool for Risk-Based Watershed Health Management) to include the additional effort detailed under Tasks 1 and 2. The contractor shall prepare the QAPP to reflect current LRPCD format. LRPCD QAPP templates in the current QAPP format will be provided by the WACOR or the LRPCD QA manager. The QAPP will be reviewed by an EPA quality assurance specialist and EPA WACOR and, if necessary, be revised by the contractor.

The contractor shall co-author a journal article on the revised R-R-V and WH analysis with the EPA WAM within 6 months from the work assignment period of performance start date.

Task 2: Relating Risk indicators to watershed attribute and climate variables

The contractor shall conduct risk assessment such that R-R-V and the composite index is computed for each subwatershed/catchment within the three river basins at multiple scales (i.e., for selected stream orders), as opposed to carrying it on a station by station basis. The display of R-R-V and WH values spatially allow users to isolate critical areas. The contractor shall work with the EPA WACOR to develop static regression

relationships for the R-R-V and WH measures as a function of watershed attributes and annually-averaged hydro-climate variables.

The contractor shall provide the EPA WACOR a user manual for the revised DST and coauthor a manuscript on the task findings within 12 months from the start date of the work assignment period of performance.

Quality Assurance

All research activities which use or produce models must follow the guidance of ORD policy and procedures manual section 13.9, *Modeling Quality Assurance and Documentation*: ORD PPM 13.9.

ORD PPM 13.9

Research records shall follow the applicable policy for laboratory notebooks, according to ORD policy and procedure manual section 13.2, *Paper Laboratory Records.*

Copies of the current Quality Assurance policies may obtained here: Chapter 13 Policy and Procedures Manual.

The tasks and subtasks in this work assignment identify QAPPs which will or may require revision. QAPP revisions must be reviewed and approved by the LRPCD QA manager before research begins under this work assignment.

References:

Kjeldsen T. R. and Rosbjerg D., 'Choice of Reliability, Resilience and Vulnerability Estimators for Risk Assessments of Water Resources Systems', 2004, *Hydrological Sciences*, V. 45 No. 9, p. 755-767.

Hoque, Y., M.M. Hantush, R.S. Govindaraju. 2014. On the Scaling Behavior of Reliability-Resilience-Vulnerability Indices in Agricultural Watersheds. Ecological Indicators. 40, 136-146.

Hoque, Y., C. Raj, M.M. Hantush, I. Chaubey, and R. Govindaraju. 2013. "How Do Land-Use and Climate Change Affect Watershed Health? A Scenario-Based Analysis". *Water Quality, Exposure and Health*. DOI 10.1007/s12403-013-0102-6

Hoque, Y., S. Tripathi, M. Hantush, and R. Govindaraju. 2012. " Watershed Reliability, Resilience and Vulnerability Analysis under Uncertainty Using Water Quality Data." *J. Environ. Magmnt.* 109, 101-112.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-28

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	To	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X	Option Period Number	Water Availability and Water Q

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	4A, 4C, and 4E

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

Period of Performance: From 12/10/2015 To 09/29/2016

Comments:
The contractor is authorized to start work on all PWS tasks at work assignment issuance.

☐ 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 (Max 7)
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5										

Authorized Work Assignment Ceiling

Contract Period: To — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name Jeff Yang	(Signature)	(Date)	Branch/Mail Code:
			Phone Number 513-569-7655
			FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7196
			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
Contract No. **EP-C-15-010**
Work Assignment 0-28

TITLE: Complete water Availability and Water Quality Forecasting Tool with Environmental Change Reconstruction

Work Assignment Contracting Officer's Representative:

Jeff Yang, Ph.D.
Urban Water Management Branch
Water Supply and Water Resources Division
U.S. EPA National Risk Management Research Laboratory
Cincinnati, Ohio 45268
Phone: 513-569-7655
yang.jeff@epa.gov

Alternate WACOR:

Sam Hayes, Ph.D.
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U.S. EPA National Risk Management Research Laboratory
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PERIOD OF PERFORMANCE: CO Issuance to September 29, 2016

Background

US EPA is implementing a series of systematically planned and organized research under the Air Climate and Energy (ACE) and the Sustainable Water Resources (SSWR) research programs. Some research activities are implemented in the EPA Water Resources Adaptation Program (WRAP) for sustainable development of water resources and infrastructures. Recently, the WRAP activities are focused on coastal areas under the impact of climate change and storm surges, and on ways to improve water infrastructure resilience and adaptability against climate-related physical (e.g., flooding) and environmental damages.

Specifically, the research actions require developing technical capability for timely water quality monitoring and water availability projections for infrastructure planning and operation. This work assignment aims to support the SSWR and ACE research priorities. Past years of development has resulted in the emergency of a near real-time satellite-based water quality monitoring system. During this Period of Performance, the work assignment WA 0-28 shall be focused on testing and further evaluation of the water quality monitoring platform in coastal regions. Specific research activities are described below.

TASKS:

Task 1 Provide EPA the real-time water quality monitoring system

In this WA task, the Contractor shall take the results of research completed under EPC11006, WA 4-28, and complete the water quality monitoring system for testing and evaluation at Massachusetts coastal regions. Specifically, the Contractor should provide to EPA the platform for real-time daily monitoring of water quality including the methodology and satellite fusion techniques. The Contractor shall provide necessary on-site training to EPA and set-up the remote sensing equipment for conducting real-time water quality monitoring.

Deliverable:

1) Satellite-based remote sensing operational protocols and for near real-time water quality monitoring, by June 1, 2016;

2) Development of remote sensing based water quality station in EPA AWBERC facility, by July 30, 2016.

Task 2 Develop and provide water quality maps for the Mattapoisett Harbor, MA.

In this task, the Contractor shall develop and provide water quality maps for the Mattapoisett harbor located in southeastern Massachusetts along the shores of Buzzards Bay (Figure 1). The harbor receives discharge from the Mattapoisett River to the northwest. The river stretches approximately 10 miles from its headwaters at the 710-acre Snipatuit Pond to Mattapoisett Harbor. The river basin has eight public water supply wells and countless private wells serving the needs of multiple municipalities.

At the concern and for the interest of research is the hydraulic interface at the confluence of the river and the harbor. It is anticipated from existing data and river delta hydrology that the river discharge of low salinity and high Total Organic Carbon (TOC) will mix with the salt water in the Harbor. The mixing front and spatial distribution is fundamental to the salt water intrusion in the EPA project on Mattapoisett water adaptation studies. Given the hydrologic setting and research objective, the Contractor shall perform two lines of activity below:

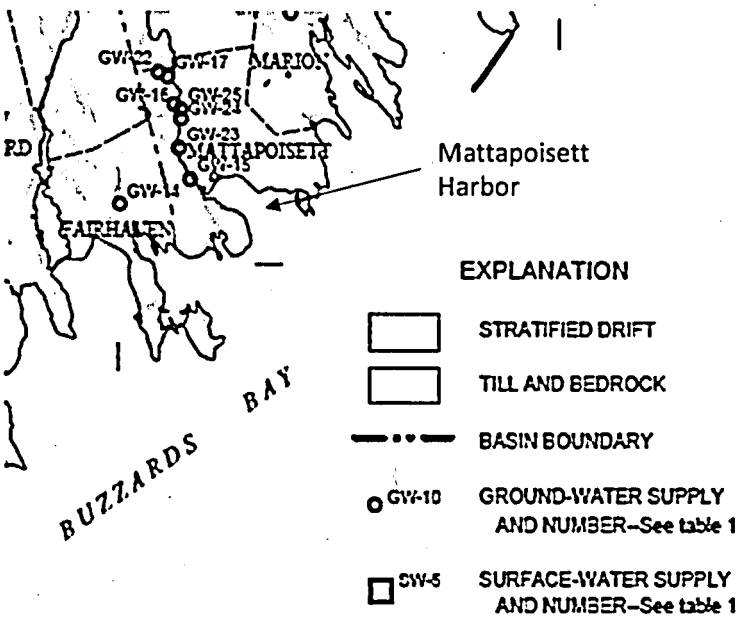

Figure 1 Map from Stream Flow, Groundwater Recharge and Discharge, and Characteristics of Surficial Deposits in Buzzards Bay Basin, Southeastern Massachusetts, US Geological Survey, Water Resources 95-4234.

1) Retrieve salt and TOC concentration maps in the Mattapoisett Bay during high and low river stages, and during high and low tide conditions. Using TOC and salinity (or conductivity) as a surrogate, produce detailed map of river flow and mixing at the river entrance to the Harbor.

2) Once calibrated, retrieve the TOC and salinity maps one month before and six months after the Hurricane Bob that landed in the New England in August 19, 1991. Representative high and low tide time snapshots for each month are sufficient.

Deliverables: 1) the maps from activity #1 shall be submitted to EPA by February 1, 2016; and 2) the maps before and after Hurricane Bob shall be submitted to EPA by April 1, 2016.

Quality Assurance Requirements

The contractor shall adhere to an existing QAPP, ID number 732-Q-2-0, which will be provided by EPA WACOR upon request.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-30

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	To	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X	Option Period Number	Laboratory support service for

Contractor: PEGASUS TECHNICAL SERVICES, INC.

Specify Section and paragraph of Contract SOW: 4E, 4F, and 4H

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

Period of Performance: From 11/04/2015 To 09/29/2016

Comments:
The contractor shall immediately start work on all tasks listed in the Work Assignment Performance Work Statement.

☐ 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 (Max 7)
1										
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Authorized Work Assignment Ceiling

Contract Period: To — 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 Endalkachew Sahle-Demessie	(Signature)	(Date)	Branch/Mail Code:
			Phone Number 513-569-7739
			FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7196
			FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code:
			Phone Number:
			FAX Number:
Contracting Official Name Candice Charlton	Candice Charlton (Signature)	11/04/2015 (Date)	Branch/Mail Code:
			Phone Number: 513-487-2007
			FAX Number:

PERFORMANCE WORK STATEMENT

Laboratory support service for instrument maintenance and material characterization

CONTRACT NO. EP-C-15-010

WORK ASSIGNMENT NUMBER: 0-30

PERIOD OF PERFORMANCE: CO Issuance through September 29, 2016

WORK ASSIGNMENT MANAGER: Endalkachew Sahle-Demessie

LOE: 2040

TASKS

Research Support for Sustainable Technologies

1. **Review Project Background:**

This work assignment is intended to support NRMRL/STD efforts in clean technologies, nanotechnology, innovative separation processes, sustainable chemistry and biotechnology research. The work assignment will have two major tasks. The first Task is conducting general QA/QC and laboratory equipment maintenance support. The second Task is supporting activities on project specific actions, such as analysis of limited number of samples using instruments in EPA or at other laboratories. Some of the specific projects that are supported by Research Action Plan are listed below.

Nanotechnology: Widespread use of nanomaterials in emerging areas for commercial and environmental applications is ongoing. As nanotechnology continues to expand, EPA/NRMRL is playing a key role in ensuring that potential risks are adequately understood to protect public health and the environment. NRMRL/STD is conducting a wide range of research on the application of nano-particle technology, the environmental fate, aging and transport of nanomaterials, "greener" synthesis of nanomaterials, membrane technologies, and water technologies.

Separation Technology: NRMRL/STD is also involved in developing innovative polymeric membrane, which presents a breakthrough in the field of desalination membranes. This technology can desalinate simulated seawater of exceptionally high concentration to produce a high flux of potable water with high levels of salt rejection in a single through pervaporation (PV) process.

Biosensor: Accurate measurement of arsenic in drinking water at levels relevant to health currently requires laboratory analysis using sophisticated and expensive techniques and facilities as well as trained

staff not easily available or affordable in many parts of the world. There are several EPA approved methods for the detection of arsenic in groundwater including inductively coupled plasma atomic emission spectrometry (ICP-AES) and graphite furnace atomic absorption spectrometry. Such technologies are laboratory-based, labor-intensive and require a significant capital investment. Stripping voltammetry has been widely used as an alternative means of trace heavy metal analysis, using either gold or mercury as the working electrode. Given the toxicity of mercury and the human health risk that it poses (bioaccumulation in the food chain), however, there have been substantial efforts to eliminate the use of mercury in chemical analysis.

Current low-cost, field-portable methods can detect high levels of arsenic (100-300 μg/L), but are far less reliable at concentrations closer to the EPA MCL. In addition, they often involve complicated procedures and dangerous chemical reagents. Several higher-sensitivity arsenic testing kits are available on the market, but they require expensive instrumentation to read the outputs, and almost all of them use highly toxic mercury bromide. Most people who get their water from domestic wells want to know whether their drinking water supply is safe from arsenic. Thus, a low cost, reliable and sensitive method based on a green chemistry approach with neither toxic chemicals nor risk to the operator is desirable. In this research, an arsenic sensitive enzyme immobilized on an electrode modified with a conducting polymer will be investigated as an alternative transducer platform for the amperometric analysis of As(III) and As(V) ions in aqueous solutions. The proposed this contract is to develop, design and build a prototype biosensor device and the determination of the detection limit, linear range, sensitivity and relative standard deviation for arsenic ions in natural waters.

The aim of this project is to build a prototype amperometric biosensor using the enzymes identified in Stage 1, and to demonstrate its effectiveness for field applications. The two or three most sensitive enzymes will be immobilized onto electrodes such as graphite modified with Pt-nanoparticles for the detection of arsenic in natural waters. Completion of the following tasks will help to achieve the goals of this project.

2. Health and Safety Plan (HASP)

All the projects supported by this contract have approved Health and Safety Plan.

3. Quality Assurance Project Plan (QAPP)

Current and future projects in STD/NRML with approved quality assurance plans including: S-10591-QP-1-0; S-140440QP-1-1, will be supported through this contract. These project have Quality Assurance Levels at Basic Research – at level IV.

4. Work / Experimental Requirements:

4.1 Task I.

4.1.1 The contractor shall performs bi-weekly quality control checks on selected analytical instruments that researchers in STD use or as required by the specific Standard Operating Procedure. These instruments are located at AWBERC (Full Containment Facility and the main AWBERC building) and include GC/MS, XRD, Surface area analyzer, elemental analyzer, LC-MS, TGA/GC/MS, NMR)

4.1.2 Contractor shall provide necessary routine supplies needed for quality control and maintenance activities.

4.1.3 Conduct shall conduct routine maintenance and support to keep the in operation, including cleaning, maintaining appropriate gases needed for equipment, and archiving data file.

4.1.4 The contractor shall maintain instrument document user history and suggest update and upgrades when needed.

4.2 Task II

4.2.1 The contractor shall perform material characterization studies as required for specific projects. These tests include but not limited to structural, morphological, texture and other characterizations of nanomaterials using microscopic and other material characterization techniques (scanning electron microscopy, Transmission Electron Microscopy, Zeta potential, particle size, Atomic Force Microscopy, Optical spectroscopy including IR and Raman).

4.2.2 The contractor shall travel to other facilities with samples where material characterization is available. There are a few relatively close facilities with these capabilities such as the University of Cincinnati, Northern Kentucky University, or University of Kentucky. This statement is not intended to "direct subcontracting" but to share information about local facilities with these specialized capabilities.

4.3 The contractor shall develop SOP for the analytical method used to characterize

5. Progress Meetings:

The contractor shall hold monthly progress meetings with the EPA WACOR. During these progress meetings there will be discussion with the WACOR on technical directions and modifications to the routine activities.

6. Expected Outputs:

6.1 The contractor shall provide request for supplies and parts needed to repair and maintain instruments in a timely way.

6.2 The contractor shall provide quarterly status update of all the analytical instruments supported.

6.3 The contractor shall provide results of experimental test will be prepared in spreadsheets format (MSExcel) including QA parameters and the analytical procedures followed by the contractor in Microsoft Word. Provide laboratory notebooks formatted according to SOP # 16.

6.4 The contractor shall provide characterization data and interpretation of data when needed.

6.5 The contractor shall prepare quality assurance reports, method detection limits for the various instruments QC checks as needed.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-31

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-010	Contract Period 09/30/2015 To 09/29/2016 Base X Option Period Number	Title of Work Assignment/SF Site Name: Life Cycle Considerations and
Contractor: PEGASUS TECHNICAL SERVICES, INC.	Specify Section and paragraph of Contract SOW: 4H - 11	

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

Period of Performance: From 08/25/2016 To 09/29/2016

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										
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Authorized Work Assignment Ceiling

Contract Period: 09/30/2015 To 09/29/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Diana Bless (Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7674 FAX Number:
Project Officer Name: Michael Moeykens (Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7196 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
EP-C-15-010
WA0-31

TITLE: Life Cycle Considerations and System Analyses of Municipal Water Sustainability Assessments

PERIOD OF PERFORMANCE: Work Plan Approval- September 29, 2016

WORK ASSIGNMENT CONTRACTING OFFICER REPRESENTATIVE (WACOR)
Diana Bless
Sustainable Technology Division
National Risk Management Research Laboratory
Office of Research and Development
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ALTERNATE WACOR:
Jennifer Cashdollar
System Exposure Division
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FAX: (513) 569-7584

A. BACKGROUND

As one of the largest federal water research and development laboratories in the United States, the Environmental Protection Agency generates innovative solutions that protect human health and the environment. The Office of Research and Development's (ORD) Safe and Sustainable Water Resources (SSWR) Program is the principle research lead seeking metrics and tools to compare the tradeoffs between economic, human health and environmental aspects of current and future municipal water and wastewater services. Changes in drinking water and wastewater management have typically resulted from new regulations, which focus on developing and implementing additions to the current treatment and delivery schemes. However, these additions are generally undertaken in the absence of a system's holistic view and result in transferring issues from one problem area to another. Future alternatives not only need to address the whole water services physical system, but also must address changes in human behavior, institutions, and water governance to aid in the provision of more sustainable water services such that water scarcity is eliminated. Water management is undergoing a paradigm shift from pollutant

removal and human health protection to resource recovery and system efficiency. An integrated sustainability assessment should be based on linkages among drinking water, wastewater, stormwater, and natural/green infrastructure contained within a watershed. Therefore, the system-level framework integrates various complimentary system-based tools to quantitatively evaluate the tradeoffs among alternative processes in a system context. To reach these goals, the alternative unit processes underneath the transformative changes need to be well understood in order to configure a robust sustainable water system design.

B. PURPOSE

The Contractor shall provide data collection and analysis of various unit processes that adopt transformative concepts such as decentralized water systems, fit for purpose and water reuse, natural/green infrastructure, water/energy nexus, and nutrient/energy recovery. Life cycle inventory of these processes shall be developed. Life cycle impact assessments shall be conducted in order to evaluate the environmental impacts and risk tradeoff in these alternative treatment options. The contractor may also focus on the system analysis of specific scenarios. For example, an analysis can be conducted to retrofit a traditional wastewater treatment plant into a resource recovery based facility. In addition, the microbial and chemical risk profiles such as QMRA-based (quantitative microbial risk assessment) assessment need to be investigated under different alternative options to provide more holistic understanding of tradeoffs. Various method developments are needed to improve several system-based metrics and tools. For this research, an EPA Technical Team consisting of experts in environmental engineering, microbial risk assessment, chemical risk assessment, LCA (life cycle assessment), emergy, system and sustainability analyses will interact with the WACOR to provide timely, pragmatic, and decisive responses to questions, which will inevitably arise regarding overcoming obstacles encountered in the course of the work. The WACOR will serve as liaison between the Contractor and a network of experts within EPA who can be called upon to provide necessary data such as technical details of water treatment technologies, appropriate values for key model parameters, and pragmatic approaches to incorporating findings from prior assessments into the LCA and other metrics and tool framework.

C. GENERAL REQUIREMENTS

In providing services under the tasks described in the WA, the contractor also shall adhere to the following general requirements:

Databases and Computer programs

The contractor shall ensure that the updated databases, computer programs and the corresponding documentation developed under this contract are accessible to the Contract Level COR (Michael Moeykens) and the WACOR (Diana Bless)/AWACOR (Jennifer Cashdollar). For better quality assurance and control, all changes in databases are documented chronologically in the databases according to QAPP requirements. The contractor shall use software packages that are relevant to particular statistical analysis, generally acceptable by experts as being reliable for the statistical analysis, and allow for any necessary data modification. The program shall identify the origin of the input data sets (e.g., version X supplied by EPA on specific date).

Deliverables

The contractor shall provide documentation in computer files, and in hardcopy, upon specific request. All the raw data, models developed, reference sources and literature supporting files need to be provided to EPA for QA support and proper record management. When appropriate (e.g., in a report rather than data listing), the contractor shall clearly specify the methods, procedures, considerations, assumptions, relevant citations, data sources, and data that support the results and any recommendations. The contractor also shall document alternative methods, procedures, and assumptions that the contractor considered in the analysis. Further, the documentation shall be labeled with the name of the contractor and the EPA contract number. All documents need to be 508 compliant.

The contractor shall ensure that documentation is created using, or easily converted to, Agency standard software formats (e.g., Microsoft Office) to facilitate EPA use and review.

Confidential Business Information
The contractor will be provided with technical information as determined by the WACOR who will also coordinate the transfer of all information. Some of the information provided by EPA may be Confidential Business Information (CBI). After receiving CBI, the contractor shall handle and analyze CBI under procedures specified in the approved contract CBI security plan and 40 CFR Part 2 Subpart B, and in accordance with contract requirements and limitations.

Contractor Identification
To avoid any perception that contractor personnel are EPA employees, the contractor shall assure that contractor personnel are clearly identified as independent contractors of EPA when attending meetings and conferences with outside parties or visiting field sites. Further, if the contractor has prepared briefing materials, the material should clearly indicate that they have been provided by a contractor working for EPA.

D. TASK DESCRIPTION

The Contractor shall submit work plans for each task. Quality Assurance Project Plan (QAPP) shall be prepared separately for each task if the natures of each task are different. If time and hours permit, components of task 3 will be discussed with the EPA Technical Team in order to determine the priority and the focus under this task. Throughout the duration of this work assignment, the contractor shall provide management and administrative services related to this work assignment, including the following:

- Perform financial oversight and prepare and submit written monthly progress reports and invoices to the EPA WACOR. These progress reports will include a detailed breakdown of costs and hours, a progress report on each task, problems encountered, percent completion of the work, anticipated activity with a schedule of deliverables for the subsequent reporting period, and a list of outstanding actions awaiting EPA authorization
- Track progress toward completion of work assignment tasks against costs.
- Provide meeting minutes for record management.

Task 1: Emergy Analysis of Constructed Wetland Used for Greywater and Stormwater Treatment

Task 1a: Quality Assurance Plan

Performance under this task requires the contractor to prepare a Quality Assurance Project Plan (QAPP) to be included as part of Task 1. The contractor shall submit a QAPP in accordance with EPA Requirements for Quality Assurance Project Plans found at www.epa.gov/QUALITY/qs-docs/r5-final.pdf. Following approval of the work plan and QAPP, the contractor can move forward on Task 1b in accordance with the quality standards established in the QAPP.

Deliverable:
QA plan: Within 20 days after work plan approval.

Task 1b: Emergy Perspectives of Constructed Wetland Treatment of Graywater and Stormwater as Alternative Wastewater Treatment Options

The contractor shall prepare a framework of emergy accounting in modeling constructed wetland treatment for water reuse. The goal of Task 1b is to collect the supporting background data and theory to construct the framework for next-step modeling. The contractor shall perform a thorough literature review on the feasibility of wetland treatment of lower strength greywater and stormwater for non-potable purposes within the urban water systems and the emergy methodology framework to handle dispersal or recycle pathways such as human waste. These general observations of how emergy accumulates and dissipates will be used to inform the emergy characterization of wastewater, nutrient and reused water in next-step work.

Deliverables:
Spreadsheets and associated data shall be made available to the EPA Technical Team for periodic review throughout the period of performance. A final report outlining the results of the analysis which covers the proposed scenarios and scales shall be delivered to EPA WACOR by September 29, 2016.

Task 2: Microbial Risk Assessment Support for Alternative Water Systems

The Contractor shall provide services in data analysis for risk assessments with a particular focus on microbial risks. The Contractor shall develop and implement innovative statistical analysis, designs and sampling plans to enable microbial risk assessment (MRA) to be integrated within broader water service sustainability assessments. For this ORD-based research, the contractor shall provide technical statistical services to interpret and aid in the development of further ORD research activities to address microbial and chemical contaminants across the whole water cycle as it relates to municipal water services, addressing traditional and novel options to manage drinking, recreational and reuse water risks, as well as risks imposed in food supply chains with resource recovery strategies such as urine as fertilizers. Components of task 2 may be discussed with the EPA Technical Team in order to determine the chemical risk assessment (CRA).

Task 2a: Quality Assurance Plan

Performance under this task requires the contractor to prepare a Quality Assurance Project Plan (QAPP) to be included as part of Task 2. The contractor shall submit a QAPP in accordance with EPA Requirements for Quality Assurance Project Plans found at www.epa.gov/QUALITY/qs-docs/r5-final.pdf. Following approval of the work plan and QAPP, the contractor can move forward on Task 2b in accordance with the quality standards established in the QAPP.

Deliverable:
QA plan: Within 20 days after work plan approval.

Task 2b: Microbial Risk Assessment

When implementing the concepts of fit-for-purpose and resource recovery, the microbial risk profiles shall be assessed in non-traditional water sources and water flows such as graywater, rainwater, stormwater, blackwater, yellow water, foundation drainage, etc. The complex alternative system designs require a consistent, robust metric to evaluate the exposure potentials in these new scenarios. In the application of dual water quality, the water quality of non-potable water needs to be closely evaluated and address the question "how safe is safe for its purpose". The contractor shall perform a thorough literature review on the microbial risk assessment to provide two aspects of knowledge: 1) appropriate standards for non-potable water from human health perspective; 2) pathogen removal efficiencies for various transformative systems, including the variability in performance due to system failure, hazardous events, or other disturbance. These general observations of how the state of art knowledge of non-potable water risk assessment and pathogen removal efficiencies for alternative treatment options will be used to inform the potential risk modeling in next-step work.

Deliverables:
All codes written, the various tools and softwares, spreadsheets and associated data shall be made available to the EPA WACOR for periodic review throughout the period of performance. A final report outlining the results of the analysis which covers the proposed scenarios and scales shall be delivered to EPA WACOR by September 29, 2016.

E. SPECIAL CONSIDERATIONS

The contractor shall prepare a cost estimate for each task to be included with the work plan cost estimate. Before starting an approved task, the contractor shall meet with the EPA WACOR and technical advisor in order to ensure that all the steps in the task are clearly understood. Technical direction will be given to the contractor via the EPA WACOR in the form of an email. Technical discussion, including, but not limited to, discussions of scheduling availability for planning around deliverables, troubleshooting regarding Task 1 or 2, issues with data interpretation, and/or other questions regarding the work assignment can be done between the contractor and the WACOR along with the PIs and EPA Technical Team. Such discussion does not constitute technical direction.

A summary of monthly expenses as it relates to the overall project budget needs to be provided. EPA may monitor progress through regular meetings between the Contractor and the EPA WACOR and the EPA Technical Team. Changes in procedures to overcome technical

difficulties can be made by mutual agreement between the contractor and the EPA WACOR/Technical Team. These changes will not change the cost of the work plan in any way. If it is determined a changes should alter the cost, an amendment to the work assignment will be issued by the Contracting Officer.

F. ACCEPTANCE PROCEDURE FOR DELIVERABLES

Deliverables shall be delivered to the EPA WACOR. The EPA WACOR will advise the contractor of any problems with deliverables within 1 week after receipt. The contractor shall submit the revised deliverable within 3 calendar days after receipt of the EPAWACOR's comments.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-38

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	09/30/2015 To 09/29/2017 Base X Option Period Number	Center Hill Lab support

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	4 A and B

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

Period of Performance: From 08/18/2016 To 09/29/2016

Comments:
The contractor shall start work upon WA issuance.

☐ 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: 09/30/2015 To 09/29/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name David Carson	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7527 FAX Number:
Project Officer Name Michael Moeykens	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7196 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
CONTRACT NO. EP-C-15-010

WORK ASSIGNMENT 0-38

IMMEDIATE START

RESEARCH LABORATORY SUPPORT SERVICES AT THE CENTER HILL RESEARCH FACILITY

Supports SHC Tasks 3.63, 3.61 and CSS Task 18.2

WORK ASSIGNMENT MANAGER:	David A. Carson
ALT WAM:	Thabet Tolaymat
PERIOD OF PERFORMANCE:	**CO Issuance through 9/29/2016**
LOCATION:	On-site at Center Hill Research Facility Cincinnati, OH

INTRODUCTION

This Work Assignment will provide general base facility support services for laboratory maintenance and research activities within the Land Remediation and Pollution Control Division at the Center Hill Research Facility (CHRF). CHRF has unique and highly specialized analytical capabilities such as X-Ray Photo Electron Spectroscopy (XPS) and wide range of instruments used for routine organic and inorganic analysis to explore innovative solutions to current and future land pollution problems.

This WA will be utilized only for base facility infrastructure support in a scenario where analysis of samples generated from basic level, bench- and pilot-scale levels experiments would be under other work assignments associated with specific projects. This work assignment covers lab maintenance issues related to the base facility infrastructure support. The work outlined is not for generation of research data.

GENERAL LABORATORY SUPPORT FUNCTIONS

1. Review

The contractor shall provide the Center Hill (CHRF) Research Facility with general support for basic lab readiness by maintaining laboratory space and equipment in compliance with all Safety, Health and Environmental Management Program Office (SHEM) requirements and Quality Assurance (QA) requirements. It is also to provide additional assistance for preparing samples for analysis, analyzing samples only for

characterization for waste disposal, preparing standards and solutions, and maintaining instruments, including performing periodic QA/QC checks in adherence to ORD policy and procedures manual section 13.4, *Minimum QA\QC Practices for ORD Laboratories Conducting Research*: PPM 13.4.

2. Tasks

Task 1. Health and Safety Plans The contractor shall advise Agency principal investigators (PIs) in cooperation with the EPA WACOR of any revisions or updates that are needed to health and safety plans (HASPs) needed to maintain laboratory readiness for analyses under separate independent WAs. In this case, the contractor shall immediately notify the Contract-level COR and WACOR if any changes to the tasks require a new or amended HASP, and then draft a new or amended HASP, supplementing the previous HASP for use by the PI. Any revisions to the HASP will be reviewed and approved by the EPA WACOR and the EPA SHEM. Updates to project-specific HASPs are not included in this work assignment.

This task also includes monthly progress and financial reports. The monthly progress report shall indicate, in a separate Health and Safety section, whether significant health and safety issues have been identified and how they are being resolved. The monthly progress report shall indicate, in a separate QA section, whether significant QA issues have been identified and how they are being resolved. Monthly financial reports must include a table with the invoice LOE and costs broken out by the tasks in this WA and reflect overall resources consumed over time versus the authorized spending ceiling. The contractor shall present these reports to the WACOR during a monthly progress meeting.

Biweekly progress meetings with the EPA WACOR are required for each task. Technical directions and any alterations to existing experiments will be discussed and documented during the biweekly progress meetings.

In addition, in each monthly progress report and meeting, the contractor shall, at the introduction to the discussion of this work assignment, discuss actual progress toward achieving the purpose of this work assignment, including problems encountered, issues that may need to be resolved, and anticipated timing for completing the goals of the work assignment. The contractor shall provide an overview of contract projects, striving to implement efficiencies in performance when complimentary requirements are issued. The contractor shall assure that duplication of effort relative to other ongoing work assignments under this contract is not occurring.

Task 2. Records Management

Research records shall follow the applicable policy for laboratory notebooks, according to ORD policy and procedure manual section 13.2, *Paper Laboratory Records*: PPM 13.2 Training.

When applicable, the contractor shall follow SOPs published by LRPCD at http://intranet.ord.epa.gov/p2/nrmrl/standard-operating-procedures-technical-lrpcd. As

SOPs are revised and new SOPs are published, the list of approved SOPs changes, therefore it is important that SOPs published at this web location be consulted when referencing LRPCD SOPs.

Task 3. The contractor shall prepare materials and chemicals for general laboratory use, clean glassware, mix standard acid/base solutions, sterilize glassware, silanization of glassware, and prepare routine microbiological media. When applicable, the contractor shall follow the most current revision of NRMRL\LRPCD research glassware preparation SOPs.

Task 4. The contractor shall perform periodic quality control checks on selected analytical instruments that researchers at CHL use or as required by the specific Standard Operating Procedure. These instruments include (but not limited to) Microwave Digestion, UV-Vis, GC, GC/MS, XRD, zeta sizer, TOC, IC, ICP, TGA, AA, ICP/MS, FTIR, DMA, and XPS). The contactor shall prepare standards for analysis, including calibration curves, QC samples, etc. using the SOPs provided by the WAM. When applicable, the contractor shall follow the most current revision of NRMRL\LRPCD SOPs available on the weblink provided in Task 2. Contractor shall conduct routine maintenance and support to keep the laboratory in operation, including cleaning, maintaining appropriate gases needed for equipment, and archiving data file. The contractor shall schedule in coordination with the WAM all Preventive Maintenance (PMs) for all the instruments listed above with the manufacturer or equipment maintenance provider.

Task 5. For the purpose of equipment calibration and the analyses of waste generated from the instrument usage, MDLs studies and QA checks only, the contractor shall analyze approximately 25 samples per month for metals, anions, TOC, organics (PAHs, PCBs, etc.), gases (methane, carbon dioxide, nitrogen, oxygen, hydrogen sulfide, etc.) using instruments such as GC, GC/MS, TOC, IC, IC, ICP, ICP-MS and AA, and using SOPs provided by the WAM. When applicable, the contractor shall follow the most current revision of NRMRL\LRPCD SOPs.

Task 6. For the purpose of quality control and maintenance activities, the contractor shall ensure the readiness of Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), XRD, XPS, Dynamic Light Scattering (Zeta potential and particle size), Atomic Force Microscopy, FTIR, Optical spectroscopy including IR and Raman). This analysis will be limited to calibration, tuning, MDLs Studies, and QA checks. The contractor shall assist in the federal acquisition of necessary routine supplies needed for these activities. When applicable, the contractor shall follow the most current revision of NRMRL\LRPCD SOPs.

Task 7. The contractor shall maintain two anaerobic digesters (that are currently operational in The Center Hill facility walk in incubator) by routinely feeding, draining, and monitoring gas production to ensure the survival of these microorganisms.

Task 8: The contractor shall monitor and maintain orderly sample storage units at the CHL facility as defined in SOP NRMRL-LRPCD-02, "LRPCD Sample Management, Storage, and Disposal Procedures".

Task 9: The contractor shall monitor and maintain the reagent water systems (Super Q and deionized or DI) at the CHL facility, as defined in NRMRL LRPCD SOP for "Reagent Water Systems." When needed the contractor shall inform the WAM if the Super Q or DI system requires replacement treatment cartridges, parts or service.

Task 10. The contractor shall maintain 3 anaerobic landfill simulation lysimeter chambers (at the Center Hill facility in high bay area) by routinely checking gas levels, regenerating catalysts, monitoring the atmospheric composition of the chambers (oxygen and hydrogen gas concentration), cleaning all of the door seals on a regular basis. Routine maintenance will also include changing vacuum pump oil, replacing gloves, and checking the integrity of the chambers (identifying leaks, holes in the chamber/gloves, and vacuum pump performance, and gasket integrity). When applicable, the contractor shall follow the most current revision of the applicable NRMRL\LRPCD SOPs.

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3. Expected Outputs:

a) Clean, sterilized, and prepared glassware, basic media and standardized acids and bases as identified by the EPAWACOR via written technical direction.

b) Provide data in spreadsheets format (Microsoft Excel) including QC parameters and the analytical procedures followed by the contractor in Microsoft Word for QC checks.

c) Prepare Quality Assurance reports, method detection limits for the various instruments as needed. When applicable, the contractor shall follow the most current revision of the applicable NRMRL\LRPCD SOPs.

d) Logbooks for the sample storage units and the reagent water systems (deionized and SuperQ reagent grade) shall be maintained with completed entries at the frequency

defined in the most current revision of the applicable NRMRL\LRPCD SOPs.

f) SOP for the LC-ICP-MS and methods for conducting speciation of As, Se, Cr, and Hg in sediments, soils, natural waters, waste water, and tissues.

PERFORMANCE WORK STATEMENT
CONTRACT NO. EP-C-15-010

WORK ASSIGNMENT 0-38

IMMEDIATE START

RESEARCH LABORATORY SUPPORT SERVICES AT THE CENTER HILL RESEARCH FACILITY

Supports SHC Tasks 3.63, 3.61 and CSS Task 18.2

WORK ASSIGNMENT MANAGER:	David A. Carson
ALT WAM:	Thabet Tolaymat
PERIOD OF PERFORMANCE:	**CO Issuance through 9/29/2016**
LOCATION:	On-site at Center Hill Research Facility Cincinnati, OH

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c) Prepare Quality Assurance reports, method detection limits for the various instruments as needed. When applicable, the contractor shall follow the most current revision of the applicable NRMRL\LRPCD SOPs.

d) Logbooks for the sample storage units and the reagent water systems (deionized and SuperQ reagent grade) shall be maintained with completed entries at the frequency

defined in the most current revision of the applicable NRMRL\LRPCD SOPs.

f) SOP for the LC-ICP-MS and methods for conducting speciation of As, Se, Cr, and Hg in sediments, soils, natural waters, waste water, and tissues.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-46

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	09/30/2015 To 09/29/2016 Base X Option Period Number	Technical Support for Evaluati

Contractor: PEGASUS TECHNICAL SERVICES, INC.

Specify Section and paragraph of Contract SOW: Section V

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

Period of Performance: From 02/16/2016 To 09/29/2016

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: 09/30/2015 To 09/29/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Vasudevan Namboodiri (Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7446 FAX Number: 513-569-7052
Project Officer Name Michael Moeykens (Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7196 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
Pegasus Contract No.: EP-C-15-010
Work Assignment 0-46

I. **Title:** Technical Support for Evaluation of Green and Sustainable Water and Wastewater Technologies

II. **Work Assignment Contracting Officer's Representative (WACOR):**
Vasudevan Namboodiri
Green Chemistry Branch
Sustainable Technology Division
U.S. EPA National Risk Management Research Laboratory
Cincinnati, Ohio 45268
Phone: 513-569-7446
Email: Namboodiri.Vasudevan@epa.gov

Alternate WACOR:
Craig Patterson
Water Quality Management Branch
Water Supply and Water Resources Division
U.S. EPA National Risk Management Research Laboratory
Cincinnati, Ohio 45268
Phone: 513-487-2805
Email: Patterson.Craig@epa.gov

III. **Period of Performance:** CO Issuance to September 29, 2016

IV. **Background:**
EPA is conducting various research studies with City governments, private industry and educational institutions to develop novel innovative sustainable technologies and to bring them to the drinking water and wastewater treatment markets. This study is investigating a research project in the area of water/wastewater disinfection. Water and waste water treatment research involves development of sustainable/greener alternatives to chlorine treatment.

V. **Technical Approach:**
Under this performance work statement (PWS), the contractor shall provide technical services to install, operate, and maintain a wide variety of treatment systems, accessories, and monitoring devices. The contractor shall provide technical support in the setup, troubleshooting, operation and maintenance of the tasks identified within this PWS and as issued/clarified through EPA WACOR's written technical direction. The contractor shall also provide technical support and test results to improve EPA's knowledge of treatment cost, operation, performance, and reliability.

A. **Collaborative Research on Water and Wastewater Treatment Technologies:**

Task 1: Comparison of Disinfection Capabilities of Water and Wastewater Treatment Technologies

The contractor shall update the existing Health and Safety Plan (HASPs) and amend the EPA-approved QAPPs to include a comparison study of the disinfection capabilities of peracetic acid (PAA) and sodium hypochlorite (NaClO) on wastewater from combined sewer overflows (CSO) and a comparison of capabilities of other disinfectants (e.g., ferrate, peracetic acid (PAA)-Ultraviolet (UV), ozone, chlorine-based disinfectants) on the production of potable water. The study also includes the toxicity of PAA in receiving water. The contractor shall conduct basic lab research (required to support the field studies) and field research studies at City of Cincinnati MSD using existing QAPP or after EPA endorsement of the QAPP amendments. The case study is also focuses on improving efficiency, reducing energy usage and improving economic aspects in wastewater treatment.

B. Water and Wastewater Technology Reports:

The contractor shall document ease of use and cost during above research studies. Study results shall be evaluated, compared, and compiled into an interim summary report for Tasks 1 above. The contractor shall provide a Draft Interim Summary Report of research progress by August 26, 2016. After addressing EPA comments, the contractor shall provide a Final Interim Summary Report by September 28, 2016.

VI. Quality Assurance/Quality Control:

The EPA WACOR will provide to the contractor approved QAPPs and HASPs related to these tasks.
QAPPs: S-19486-QP-1-2

VII. Expected Outputs – Due dates covered in section B above

Task 1. Reports on PAA in waste water treatment and toxicity studies

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-47

☐ Other ☐ Amendment Number:

Contract Number: EP-C-15-010	Contract Period 09/30/2015 To 09/29/2016 Base X Option Period Number	Title of Work Assignment/SF Site Name: Synthesis of nutrient modeling
Contractor: PEGASUS TECHNICAL SERVICES, INC.	Specify Section and paragraph of Contract SOW: Section 4, Paragraph H, Items 7 and 11	

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

Period of Performance: From 05/05/2016 To 09/29/2016

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: 09/30/2015 To 09/29/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Andrew Henderson (Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7113 FAX Number:
Project Officer Name: Michael Moeykens (Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7196 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
EPA Contract No.: EP-C-15-010
Work Assignment: 0-47

TITLE:
Synthesis of nutrient modeling in Life Cycle Assessment.

WORKASSIGNMENT CONTRACTING OFFICER'S REPRESENTATIVE (WACOR):
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PERIOD OF PERFORMANCE:
CO Work Plan Approval to September 29, 2016

BACKGROUND:

Water integrates many aspects of our nation's economic activity, with direct impacts on human health and the environment. The productivity and sustainability of our nation's marine and freshwater resources has direct impacts on human food supply (e.g., Deepwater Horizon impacts on food) or human health (e.g., harmful algal blooms). Yet the link runs both ways: the nation's agricultural regions can have direct impacts on that water quality and its productivity through emissions of nutrients from fertilizer and other substances. Simultaneously, drinking and wastewater treatment facilities must respond to changes in water quality from agricultural activity or other industries. The 2014 algal bloom in Lake Erie demonstrated this connection, showing the potential for accidental impairment of the nation's water supply.

The public and private sectors, domestically and internationally, are in the midst of a transition toward decision-making based on holistic sustainability considerations. As part of this transition, many water utilities and agricultural operations are beginning to use Life Cycle Assessment (LCA) in decision-making. LCA is a tool that quantifies impacts that may be induced by products or activities (e.g., crops or water treatment), thus helping to reduce overall impacts and to avoid shifting impacts from one area to another. For example, energy intensive nitrogen removal processes in wastewater treatment can have a high energy demand. Depending on the source of energy, that energy demand could result in net increase of nitrogen inputs to our regional water system, negating the efforts of the water utility to remove nitrogen.

In the 2011 NRC Report "Sustainability and US EPA," Life Cycle Assessment and Ecosystem Services Valuation were explicitly identified as critical tools for the EPA to use and to develop. However, some of the current shortcomings of LCA's approach to eutrophication, mentioned above, cast doubts on the value of using LCA approaches for questions related to water security, water quality, and nutrient management, especially for making regional or site-specific decisions. LCA currently uses rudimentary models to understand the fate and impact of nutrient emissions. For example, the U.S. EPA's TRACI tool does not consider temperature, flow rate, or other available environmental parameters in determining the fate of phosphorus or nitrogen emissions to water. Furthermore, there are no robust LCA models to estimate the transfer of fertilizer from agricultural fields to water bodies, the fate of nitrate in groundwater, or the potential for harmful algal blooms.

Currently, one of the standard tools in LCA is TRACI, developed by the US EPA. Given the comprehensive nature of the analysis, and the effort to be applicable at a national scale, TRACI uses very basic modeling approaches for several impact categories, including eutrophication. The TRACI eutrophication model consists of a topological hydrological model to determine whether the water body drains to the ocean, or internally (e.g., the Great Salt Lake). The Redfield ratio, a global average composition of algae, is used to convert between nitrogen and phosphorus species. Therefore, in TRACI, ammonia emissions to the Chesapeake Bay are essentially the same as phosphorus emissions to Lake Erie or to the Colorado River. This model does not reflect current understandings of these systems. By surveying existing models and knowledge that is distributed across multiple disciplines (e.g., soil science, agricultural engineering, agronomy, environmental engineering, hydraulics, and the regulatory sphere), this work will set the foundation for efficient model development – i.e., model development that does not reinvent the wheel, but rather builds on existing knowledge, thus making the best use of EPA's previous research efforts to move forward.

The Systems Analysis Branch (SAB) within the National Risk Management Research Laboratory (NRMRL) of US EPA's Office of Research and Development (ORD) is developing the necessary tools to support the use of Life Cycle Assessment (LCA) by the Office of Water (OW), the Office of Solid Waste and Emergency Response (OSWER), the Office of Air and Radiation (OAR), and Regional Offices to promote scientifically-based sustainability decisions.

PROJECT GOAL:

The purpose of this work assignment is to develop a current and comprehensive inventory of nutrient fate and eutrophication impact models, focusing on nitrogen and phosphorus emissions to water, air, soil, and groundwater. This work assignment will provide the foundation for future work in Life Cycle Impact Assessment method development.

TASKS:

Task 1: Establish Communication and Develop a Quality Assurance Project Plan

The Contractor shall contact the WACOR and schedule a kickoff project meeting. The kick-off meeting with the WACOR (may be conducted via conference call) should take place within two weeks of the work plan approval.

The contractor shall submit bi-weekly memos to the WACOR and arrange monthly teleconferences with the WACOR. This schedule may be changed by mutual agreement.

These memos and meetings will allow discussion of progress, issues that have arisen, and any other topics that affect the efficient and effective completion of the project. The Contractor shall prepare a brief summary of the discussions during the teleconference and submit a summary to the WACOR within five (5) working days after the teleconference.

All work conducted under this work assignment shall be performed pursuant to an EPA-approved Quality Assurance Project Plan (QAPP). The contractor shall develop a QAPP within 30 days after the project begins, for review and approval by the WACOR and the EPA QA Officer.

The QAPP shall outline the approach and measures the Contractor will implement to ensure a high standard of quality in data analysis and written deliverables. The QAPP shall be in conformance with EPA's Requirements for Quality Assurance Project Plans (EPA QA/R-5). All electronic deliverables (i.e., computer files) shall be submitted in a format acceptable to EPA.

Task 2: Review and Summarize Existing Modeling Approaches for Fate and Transport of Nutrients

The contractor shall perform a review of existing fate and transport models and modeling approaches for nitrogen compounds, phosphorus compounds, and biological oxygen demand (BOD or chemical, COD) in environmental compartments. Here, 'modeling approaches' indicates concepts or frameworks for modeling that may not yet have been implemented in an operational model. The review shall include Life Cycle Impact Assessment (LCIA) literature as well as the broader ecological modelling literature.

For prioritization purposes, environmental compartments of interest to this project are organized by priority. Compartment 1 (surface freshwater) is considered as the first priority followed by, Compartment 2 (atmospheric), Compartment 3 (marine water), and Compartment 4 (groundwater). Data collection and synthesis efforts are to proceed stepwise through the compartments, following consultation and approval by the WACOR.

Acceptable data sources include the following: 1. Peer Reviewed Scientific and Engineering Literature, 2. Scholarly Theses and Dissertations, 3. Published EPA Reports, 4. Data from Unpublished EPA Field Studies (if approved by COR), 5. State and Federal agency reports, 6. Model user manuals and guidance, 7. Models from nonprofits or private groups (e.g., the Natural Capital Project), 8. Other sources, pending approval by the WACOR.

The review shall collect information about the models and modeling approaches that includes, but is not limited to the following:

- geographic area covered (e.g., watershed-specific, US-wide, or global),
- spatial resolution (e.g., grid cells of X by Y km, or USGS HUC-2 polygons, etc.),
- temporal scale (e.g., daily, monthly, or annual time steps),
- inputs required (e.g., temperature, flow rate, etc.),
- underlying conceptual model (e.g., equations used to model the fate of nutrients).

The review information shall be collected both in summary tables as well as brief (1 page) descriptions of the models. All documents shall be prepared in standard office software. Bibliographic information

for models and other literature cited shall be collected and provided in a format specified by the WACOR via written technical direction.

Task 3: Review and Summarize Existing Modeling Approaches for Ecosystem Effects of Nutrients

Please note: Task 3 can only begin after receipt of written technical direction from the EPA WACOR.

The contractor shall perform a review of existing ecological effect models and modeling approaches for nitrogen and phosphorus compounds in environmental compartments. For prioritization purposes, environmental compartments and compounds of interest to this project are organized by priority. Compartment 1 (surface freshwater, phosphorus) is considered as the first priority followed by Compartment 2 (estuarine systems, nitrogen), Compartment 3 (marine systems, nitrogen), and Compartment 4 (terrestrial systems, phosphorus and nitrogen). Data collection and synthesis efforts are to proceed stepwise through the compartments, in coordination with the WACOR.
The review shall collect information about the models and modeling approaches that includes, but is not limited to the following:

- geographic area covered (e.g., watershed-specific, US-wide, or global),
- temporal scale (e.g., daily, monthly, or annual time steps)
- inputs required
- underlying conceptual model (e.g., equations used to model effects).
- types of effects (species, ecological, etc.) considered.

In other aspects, requirements and deliverables for Task 3 are the same as those of Task 2

DELIVERABLES:

Task 1:

Deliverable 1.1: The Contractor shall submit a draft QAPP to the WACOR for review, within 30 days after Work Plan Approval. The WACOR will return the draft QAPP with comment within two (2) weeks after receipt.

Deliverable 1.2: The Contractor shall submit a revised QAPP addressing the WACOR and QA Officer's comments. Due one (1) week after receiving comments from the WACOR. The final EPA signed QAPP will be returned to the Contractor within two (2) weeks.

Deliverables 1.3: The contractor shall submit bi-weekly memos to the WACOR and arrange monthly teleconference meetings with the WACOR. The contractor shall prepare a brief summary of the discussion of the teleconference and submit a summary to the WACOR within five (5) working days after the teleconference.

Task 2:

Deliverable 2.1: For *each* of the compartments listed in the description of Task 2 (freshwater, etc.), The Contractor shall submit a draft table of models and modeling approaches, summarizing the

information identified above (geographic area, etc.). The Contractor shall also submit brief (1-2 page) draft descriptions of each model or modeling approach. The WACOR will provide comments on the draft documents within two (2) weeks of receiving these documents. The Contractor shall deliver final tables and summaries within two (2) weeks of receiving comments from the WACOR.

Deliverable 2.2: The Contractor shall prepare a report for the WACOR synthesizing findings with respect to modeling in Life Cycle Impact Assessment (LCIA). For each of the compartments described above, the report should categorize and summarize modeling approaches, placing all models on a conceptual continuum of at least two dimensions: simple to complex, and extent of coverage (local to global). Following consultation with the WACOR, the report shall identify those modeling approaches that are most appropriate for an LCIA context. The report shall be approximately 8,000 – 10,000 words (not counting figures and tables).

Task 3:
Deliverables for Task 3 shall be the same as for Task 2, but focusing on the ecological effects and compartments in the Task 3 description.

Reporting
All documentation and reporting under this Work Assignment shall be in compliance with contract requirements. Additional requirements specific to this Work Assignment are as follows:

Electronic deliverables must be in an original file format that can be supported by EPA after the end of the Period of Performance of the Work Assignment. The standard office software at EPA is MS Office. Furthermore, MS Word documents longer than two (2) pages must use built-in MS Word heading styles (see https://support.office.com/en-us/article/Add-a-heading-3eb8b917-56dc-4a17-891a-a026b2c790f2).

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-49

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X To Option Period Number	WQ at Congress Run

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	Section B; Monitoring and Evaluation

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

Period of Performance: From 10/16/2015 To 09/29/2016

Comments:
The contractor is to immediately start work on all tasks listed in the Work Assignment Performance Work Statement upon the Contracting Officer's issuance

☐ 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 (Max 7)
1										
2										
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5										

Authorized Work Assignment Ceiling

Contract Period: To — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name Scott Jacobs	(Signature)	(Date)	Branch/Mail Code: Phone Number 513-569-7223 FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-569-7196 FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code: Phone Number: FAX Number:
Contracting Official Name Candice Charlton	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-487-2007 FAX Number:

WA 0-49, Pegasus Technical Services, Inc., Contract # EP-C-15-010

Performance Work Statement

Title: Water Quality Monitoring of Green Infrastructure (GI) and Daylighting of Congress Run

WACOR:
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Introduction

This project is intended to establish support for water quality monitoring for the analysis of performance of Green Infrastructure stormwater control measures at the site to watershed scale. This research is focused on the Mill Creek watershed as it relates to Project Groundwork, a major investment in GI and water quality improvement being implemented by Metropolitan Sewer District of Greater Cincinnati (MSDGC) to daylight a portion of Lick Run and to disconnect and remove surface water components from the combined sewer system that is currently defined as the Lick Run Interceptor. To inform this daylighting effort and the investments for Project Groundwork, a related and geographically similar site and effort being planned for Congress Run (a tributary to Mill Creek) will be monitored and evaluated. Restoration of Congress Run will include daylighting a 600' section of buried stream currently running beneath Hartwell Golf Course, restoration of an additional 400' of Congress Run, and restoration of 3600' of Mill Creek near the confluence with Congress Run. Water quality will be monitored before, during, and after restoration to investigate the impact from this investment and the potential for water quality improvements in Congress Run and Mill Creek.

Project Background

Green Infrastructure (GI) is promoted and implemented as an alternative to gray or traditional stormwater management that contributes to combined sewer overflows (CSOs). In Cincinnati, MSDGC has entered into a Consent Decree (CD) with USEPA to remove or reduce the combined sewer overflow volume released to surface waters and has incorporated GI into strategies to meet required reductions set forth in the CD. The intended result from these reductions is an improvement in surface water quality in receiving bodies to these CSOs. Mill Creek is an urban stream that is the receiving body to many CSOs including the largest in the MSDGC service area, CSO #5/Lick Run Interceptor.

A project has been initiated to daylight a portion of Congress Run, a tributary to the Mill Creek Watershed located in Hartwell Ohio, working under a grant recently awarded by the Ohio EPA Water Resource Restoration Sponsor Program which is funded by USEPA. A conceptual design from this grant application for the restoration work in Congress Run and Mill Creek is included here as an attachment (document file name Hartwell Restoration Concept Drawings 07-2014.pdf). USEPA is supporting MSDGC and the Mill Creek Watershed Council of Communities (MCWCC) in this effort by performing chemical and biological monitoring at the site, separate from the grant process and restoration which is currently in the initial planning phase. MSDGC has several research efforts directed toward mitigation of CSO events and reduction of overflow volumes and the district has significant interest in measuring and demonstrating the potential impact and water quality improvement in Mill Creek from these investments. This project will establish long-term water quality monitoring to support the restoration of Congress Run and to investigate the potential improvement to water quality and aquatic habitat in Congress Run and in Mill Creek as the receiving body. It will also serve to guide future restoration efforts for urban streams, and will provide MSDGC and MCWCC a demonstration and data from an active restoration in order to evaluate the impact on water quality from GI investments at a watershed level and to inform the larger daylighting effort under way for Lick Run. The restoration will pursue multiple objectives held by project partners including improved water quality, restored habitat, protection of infrastructure, and increased recreational utility, all of which support the vision of a healthy Mill Creek as an asset to the region that improves the quality of life for residents in the watershed.

HASP

A draft HASP has been prepared by USEPA and this will be provided to the contractor within 2 weeks of issuance of this work assignment. NRMRL SHEM staff have completed a preliminary site evaluation for the potential need to enter a confined space (the culvert) and are planning a more extensive analysis of conditions inside the culvert to be completed within 2 weeks. The contractor shall review this draft HASP and provide comments for completing this safety plan and for preparing a final version for submission to NRMRL SHEM prior to initiating on-site activities or lab work to support this project. The Contractor shall conduct field sampling and laboratory analyses in a manner consistent with the approved project and laboratory HASPs and in accordance with NRMRL health and safety procedures.

QAPP

The Contractor shall prepare, revise and update a QAPP for this project in accordance with the NRMRL QMP which will be a Category B document. This QAPP shall be similar to L16256-QP-1-6, which described water quality monitoring at a separate GI site but will incorporate changes described here for monitoring of Congress Run and Mill Creek.

Work/Experimental Requirements

The contractor shall develop and implement site water quality monitoring at locations specified herein that are relative to the restoration work planned. This will include five locations within Congress Run and at two locations within Mill Creek. This shall be done to compare before, during, and after restoration of Congress Run toward the project objectives including improvements in water quality and the provision of aquatic habitat. During the WA period of performance, this project will establish baseline water quality parameters prior to the initiation of restoration activities which are currently planned to commence during summer to fall of 2016. The restoration will be the responsibility of MCWCC and EPA; the contractor will have no role in implementation of restoration activities, other than to coordinate water quality sampling and monitoring activities with MCWCC as they initiate and execute restoration work on site. Sampling locations described for the culverted section will become new parallel sampling locations at similar points in the newly developed stream bed. While baseline data is to be collected during this WA PoP, it is anticipated that monitoring will continue for a minimum of three years to target before, during, and after restoration and hence a plan shall include methods suitable for monitoring beyond the initial baseline sampling period planned for this WA PoP.

The specific tasks to accomplish the study objectives are as follows:

a. **Sampling Locations**. Seven locations shall be established, and these are:

    1. Upstream/reference reach (sampling location A; MSD site/reference reach located at 225 W. Galbraith Rd, Cincinnati Ohio).
    2. At the entrance to the culverted section beneath Hartwell Golf Course (sampling location B),
    3. At a point near the center of the 600' culverted reach beneath Hartwell Golf Course (sampling location C),
    4. At a point near the end (but inside of) of the culverted reach at a point 15' or more upstream from the culvert exit (sampling location D),
    5. At a point roughly 60' downstream of the exit culvert co-located with the USGS gaging station (sampling location E).
    6. Upstream from proposed restoration (sampling location F) and
    7. At a point below the confluence with Congress Run and restored section of Mill Creek (sampling location G).

    Continuous monitoring includes these two sampling locations to be established in Mill Creek. Monitoring equipment and samples collected from within Mill Creek shall be measured or collected at a point near the center of the stream at a depth of 12 to 24" below the surface.

    During flooding or high water events, sampling locations for the two points within Mill Creek may need to be adjusted in order to collect samples within an

acceptable margin of safety. In this case, the contractor shall consult with the EPA WACOR prior to sample collection activities.

b. **Baseline sampling**. Water quality monitoring shall include baseline sampling by grab samples at monthly intervals where possible. "Baseline" or "base flow" shall be defined as stream conditions with sufficient flow or water to collect samples and a time period with no preceding storm contribution in the Congress Run watershed within a minimum of 48 hours prior to sampling. Baseline sampling is to occur 12 times within this WA period of performance, on a routine and monthly basis where possible and where baseline flow conditions allow collection of these samples. If precipitation continues throughout a period where baseline samples are needed to remain on this schedule, the conditions for what determines baseline conditions (lack of precipitation for 48 hours) may need to be revised and will require consultation with the EPA WACOR. For baseline flow sampling, each of the seven sampling locations (A-G) will be sampled.

c. **Storm sampling.** Water quality monitoring shall include a suite of parameters to be collected and measured during 6-9 runoff generating or "storm" events per WA PoP, with the objective of collecting 2-3 storm events during the spring, summer, and fall seasons. The fall season may be expanded into winter if dry conditions in fall and warm conditions in winter allow. If collection of storm events shall extend into fall/winter seasons beyond the WA PoP end date, collections will be dependent on the exercise of Option Period 1 and the issuance of a new Work Assignment. "Storm" event conditions shall be defined as precipitation of at least 0.75" in 48 hours or less resulting in increased flow in Congress Run. Should snow melt result in similar conditions to these for precipitation, a storm event sampling may be instigated. The goal is to collect representative samples for the rising limb, peak flow, and falling limb of each storm event captured and at each of the seven sampling locations for the study site. A total of 8 time points are to be collected for each storm event sampled and these will be collected at four sampling locations, B, E, F, and G.

Commented [CC1]: Are you referring to fall of 2016? And winter 2016/20177 The PoP of this WA ends on September 29, 2016. If this was your intention with these statements, I think we should include the following: ""

Storm or run-off generating events shall be sampled using ISCO automated sampling units. Where possible, flow-proportional sampling will be employed to capture the rising limb, peak flow, and falling limb of storm events and coordinated with gaging being installed on Congress Run at point E under a separate agreement with USGS. Where flow-proportional sampling is not possible, time-weighted sampling will be employed with an objective to collect similar time points during storm events at four locations; that being rising limb, peak flow, and falling limb of a hydrograph of each storm event. Data for this hydrograph will be provided in real time through the USGS web interface for gaging stations. Sample volumes collected shall be sufficient to provide for each of the analyses planned and temporary storage of an additional volume (20%) to

provide a back-up sample portion in case material is lost, a QC failure is encountered, or an analyte measurement must be repeated for any reason.

Analytes to be measured for storm or a run-off generating event sampling points shall include:

1. total suspended solids/volatile suspended solids (TSS/VSS),
2. suspended solids concentration (SSC),
3. metals and salts typical in urban runoff (e.g., Ca, Cd, Cu, Mg, Pb, Zn) (EPA Method 6010B/C),
4. chemical oxygen demand (COD),
5. biological oxygen demand (BOD),
6. density of traditional fecal indicator bacteria by Colilert method (total coliforms, *E. coli*),
7. total and dissolved nutrients (total nitrogen, ammonia, nitrate, nitrite, total phosphorus, total and dissolved reactive phosphorus [orthophosphate]),
8. total and dissolved organic carbon (TOC and DOC).

d. **YSI 6600 Sondes.** Sample collection for baseline and storm events will be augmented by real-time monitoring of specific water quality parameters by sondes installed and maintained at seven locations in Congress Run and the adjacent section of Mill Creek that relate to the proposed restoration. Nitratax probes shall be installed at three of these seven locations, at points B, C, and E. Monitoring at these locations will be continuous and will include the following biophysical parameters: pH, temperature, ORP, conductivity, dissolved oxygen, and chloride. These shall be measured using YSI 6600 sondes that are regularly calibrated and maintained. Calibration and maintenance of these sondes will be the responsibility of USEPA and will be performed on a schedule to allow PTSI to deploy and retrieve sondes at intervals expected to be between 2 and 4 weeks. The schedule for calibration and maintenance of these sondes shall be sufficient to ensure consistent data from each parameter meeting standard minimum quality control requirements and these will be established based on past experience on similar projects and described in the project QAPP.

e. **Nitratax probes**. In addition to the continuous data from the sondes described above, nitrate concentrations will be monitoring continuously using Nitratax probes at the three sampling locations in Congress Run, corresponding to points A, C, and E described above. Nitratax probes will require regular cleaning and calibration as per the manufacturer's standard protocols for these instruments which are accessible from the manufacturer (Hach).

f. **QA/QC**. The contractor shall establish and maintain strict quality assurance/quality control (QA/QC) parameters such as precision, accuracy, and method detection limits for each method and sonde or probe, providing a written

record for each method, data management support, and file archiving. The contractor shall flag instances where QC parameters for precision, accuracy and method detection limits fail so any associated data affected can be qualified, and will notify the EPA WACOR within 72 hours where QA/QC failures occur.

Quality Assurance

All research activities which generate data must follow the guidance of ORD policy and procedures manual section 13.4, *Minimum QA\QC Practices for ORD Laboratories Conducting Research*: PPM 13.4 Training.

Research records shall follow the applicable policy for laboratory notebooks, according to ORD policy and procedure manual section 13.2, *Paper Laboratory Records*: PPM 13.2 Training.
Copies of the current Quality Assurance policies may obtained here: Chapter 13 Policy and Procedures Manual.

When applicable, the contractor shall follow SOPs published by LRPCD at http://intranet.ord.epa.gov/p2/nrmrl/standard-operating-procedures-technical-lrpcd. As SOPs are revised and new SOPs are published, the list of approved SOPs changes, therefore it is important that SOPs published at this web location be consulted when referencing LRPCD SOPs.

The tasks and subtasks in this contract action identify QAPPs which will or may require revision. QAPP revisions must be reviewed and approved by the LRPCD QA manager before research begins under this work assignment.

Progress Meetings

The Contractor shall participate in monthly progress meetings, as requested, with the WACOR and shall provide information concerning the progress of laboratory activities, notify the WACOR of problems including QA/QC flags or failures, and review results. If appropriate, other EPA staff may attend these meetings at the request of the WACOR. The Contractor shall prepare summaries or minutes of these meetings and distribute to the WACOR.

Expected Outputs

a) Data shall be provided in the form of electronic records in a format suitable for further manipulation (Excel or specific instrument software packages (e.g. ICP)); QA/QC data shall be included with each dataset. QC failures should be communicated as soon as possible in order to rectify problems before they affect ongoing data collection activities. Project data shall include electronic records detailing each sampling event (storm or baseline), including but not limited to the sample ID, collection date and time, processing date and time, and preservation method associated with each sample. Project data shall also include all data sets as collected from each sonde or probe deployed as part of this project and highlight QC-related problems and suggest

corrective actions needed should QC failures occur. Data shall be posted to a share drive folder dedicated to this project within 8 weeks of sample collection, and in this 8 weeks all processing and final data review for QA/QC will be completed. Data from sondes and probes will be uploaded to this same share file within 4 weeks following the return of the instrument to AWBERC for cleaning, calibration, downloading of the data from the instrument and data from sondes and probes will be reviewed for quality assurance, for drift, and for any problems encountered with the specific instrument deployed.

b) Laboratory notebooks and field equipment logs detailing maintenance, repair and deployment records must be kept in accordance with LRPCD laboratory protocols and QA/QC procedures and must be accessible within two weeks when requested by the EPA WACOR.

c) A monthly report describing progress made, events sampled, and any problems or concerns encountered for this project shall be prepared and submitted to the WACOR.

Comments

Potential Rooms/Labs (not necessarily inclusive): Rooms 401, 428-430, 436, 715, 729; potential laboratory instruments include, but are not limited to, Shimadzu TOC/DOC/TNM/SSM, SEAL Analytical Colorimetric Analyzer, Lachet, ICP, ovens, field meters, data sondes, and various other laboratory equipment as directed by EPA and provided on the schedule of property available for use by the contractor.

Primary Project Objectives:

1. To determine potential changes in water quality and improvement from daylighting and restoration within Congress Run and restoration being done in the main channel of Mill Creek above the confluence of Congress Run.

Secondary Project Objectives:

1. To compare nutrient, TSS/VSS, SSC, and metals removal efficiencies before, during and after restoration and daylighting.
2. To determine if water quality improvements are dependent on flow rate.
3. To determine loading of nutrients, metals, sediments to the receiving body Mill Creek.
4. To determine if there is a seasonal/temporal component to nutrient concentrations or loads for conditions both before and after restoration. This PWS is to establish the "before restoration" condition in FY16.
5. To coordinate water quality monitoring (under this PWS) with biological monitoring being done by USEPA at the site before, during, and after restoration and daylighting to investigate the impacts from a. construction and b. restoration following construction and to compare these to baseline conditions existing prior to restoration and daylighting of the stream.

WA 0-49, Pegasus Technical Services, Inc., Contract # EP-C-15-010

Performance Work Statement

Title: Water Quality Monitoring of Green Infrastructure (GI) and Daylighting of Congress Run

WACOR:
Scott Jacobs
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ALT WACOR:
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Introduction

This project is intended to establish support for water quality monitoring for the analysis of performance of Green Infrastructure stormwater control measures at the site to watershed scale. This research is focused on the Mill Creek watershed as it relates to Project Groundwork, a major investment in GI and water quality improvement being implemented by Metropolitan Sewer District of Greater Cincinnati (MSDGC) to daylight a portion of Lick Run and to disconnect and remove surface water components from the combined sewer system that is currently defined as the Lick Run Interceptor. To inform this daylighting effort and the investments for Project Groundwork, a related and geographically similar site and effort being planned for Congress Run (a tributary to Mill Creek) will be monitored and evaluated. Restoration of Congress Run will include daylighting a 600' section of buried stream currently running beneath Hartwell Golf Course, restoration of an additional 400' of Congress Run, and restoration of 3600' of Mill Creek near the confluence with Congress Run. Water quality will be monitored before, during, and after restoration to investigate the impact from this investment and the potential for water quality improvements in Congress Run and Mill Creek.

Project Background

Green Infrastructure (GI) is promoted and implemented as an alternative to gray or traditional stormwater management that contributes to combined sewer overflows (CSOs). In Cincinnati, MSDGC has entered into a Consent Decree (CD) with USEPA to remove or reduce the combined sewer overflow volume released to surface waters and has incorporated GI into strategies to meet required reductions set forth in the CD. The intended result from these reductions is an improvement in surface water quality in receiving bodies to these CSOs. Mill Creek is an urban stream that is the receiving body to many CSOs including the largest in the MSDGC service area, CSO #5/Lick Run Interceptor.

A project has been initiated to daylight a portion of Congress Run, a tributary to the Mill Creek Watershed located in Hartwell Ohio, working under a grant recently awarded by the Ohio EPA Water Resource Restoration Sponsor Program which is funded by USEPA. A conceptual design from this grant application for the restoration work in Congress Run and Mill Creek is included here as an attachment (document file name Hartwell Restoration Concept Drawings 07-2014.pdf). USEPA is supporting MSDGC and the Mill Creek Watershed Council of Communities (MCWCC) in this effort by performing chemical and biological monitoring at the site, separate from the grant process and restoration which is currently in the initial planning phase. MSDGC has several research efforts directed toward mitigation of CSO events and reduction of overflow volumes and the district has significant interest in measuring and demonstrating the potential impact and water quality improvement in Mill Creek from these investments. This project will establish long-term water quality monitoring to support the restoration of Congress Run and to investigate the potential improvement to water quality and aquatic habitat in Congress Run and in Mill Creek as the receiving body. It will also serve to guide future restoration efforts for urban streams, and will provide MSDGC and MCWCC a demonstration and data from an active restoration in order to evaluate the impact on water quality from GI investments at a watershed level and to inform the larger daylighting effort under way for Lick Run. The restoration will pursue multiple objectives held by project partners including improved water quality, restored habitat, protection of infrastructure, and increased recreational utility, all of which support the vision of a healthy Mill Creek as an asset to the region that improves the quality of life for residents in the watershed.

HASP

A draft HASP has been prepared by USEPA and this will be provided to the contractor within 2 weeks of issuance of this work assignment. NRMRL SHEM staff have completed a preliminary site evaluation for the potential need to enter a confined space (the culvert) and are planning a more extensive analysis of conditions inside the culvert to be completed within 2 weeks. The contractor shall review this draft HASP and provide comments for completing this safety plan and for preparing a final version for submission to NRMRL SHEM prior to initiating on-site activities or lab work to support this project. The Contractor shall conduct field sampling and laboratory analyses in a manner consistent with the approved project and laboratory HASPs and in accordance with NRMRL health and safety procedures.

QAPP

The Contractor shall prepare, revise and update a QAPP for this project in accordance with the NRMRL QMP which will be a Category B document. This QAPP shall be similar to L16256-QP-1-6, which described water quality monitoring at a separate GI site but will incorporate changes described here for monitoring of Congress Run and Mill Creek.

Work/Experimental Requirements

The contractor shall develop and implement site water quality monitoring at locations specified herein that are relative to the restoration work planned. This will include five locations within Congress Run and at two locations within Mill Creek. This shall be done to compare before, during, and after restoration of Congress Run toward the project objectives including improvements in water quality and the provision of aquatic habitat. During the WA period of performance, this project will establish baseline water quality parameters prior to the initiation of restoration activities which are currently planned to commence during summer to fall of 2016. The restoration will be the responsibility of MCWCC and EPA; the contractor will have no role in implementation of restoration activities, other than to coordinate water quality sampling and monitoring activities with MCWCC as they initiate and execute restoration work on site. Sampling locations described for the culverted section will become new parallel sampling locations at similar points in the newly developed stream bed. While baseline data is to be collected during this WA PoP, it is anticipated that monitoring will continue for a minimum of three years to target before, during, and after restoration and hence a plan shall include methods suitable for monitoring beyond the initial baseline sampling period planned for this WA PoP.

The specific tasks to accomplish the study objectives are as follows:

a. **Sampling Locations**. Seven locations shall be established, and these are:

    1. Upstream/reference reach (sampling location A; MSD site/reference reach located at 225 W. Galbraith Rd, Cincinnati Ohio).
    2. At the entrance to the culverted section beneath Hartwell Golf Course (sampling location B),
    3. At a point near the center of the 600' culverted reach beneath Hartwell Golf Course (sampling location C),
    4. At a point near the end (but inside of) of the culverted reach at a point 15' or more upstream from the culvert exit (sampling location D),
    5. At a point roughly 60' downstream of the exit culvert co-located with the USGS gaging station (sampling location E).
    6. Upstream from proposed restoration (sampling location F) and
    7. At a point below the confluence with Congress Run and restored section of Mill Creek (sampling location G).

    Continuous monitoring includes these two sampling locations to be established in Mill Creek. Monitoring equipment and samples collected from within Mill Creek shall be measured or collected at a point near the center of the stream at a depth of 12 to 24" below the surface.

    During flooding or high water events, sampling locations for the two points within Mill Creek may need to be adjusted in order to collect samples within an

acceptable margin of safety. In this case, the contractor shall consult with the EPA WACOR prior to sample collection activities.

b. **Baseline sampling.** Water quality monitoring shall include baseline sampling by grab samples at monthly intervals where possible. "Baseline" or "base flow" shall be defined as stream conditions with sufficient flow or water to collect samples and a time period with no preceding storm contribution in the Congress Run watershed within a minimum of 48 hours prior to sampling. Baseline sampling is to occur 12 times within this WA period of performance, on a routine and monthly basis where possible and where baseline flow conditions allow collection of these samples. If precipitation continues throughout a period where baseline samples are needed to remain on this schedule, the conditions for what determines baseline conditions (lack of precipitation for 48 hours) may need to be revised and will require consultation with the EPA WACOR. For baseline flow sampling, each of the seven sampling locations (A-G) will be sampled.

c. **Storm sampling.** Water quality monitoring shall include a suite of parameters to be collected and measured during 6-9 runoff generating or "storm" events per WA PoP, with the objective of collecting 2-3 storm events during the spring, summer, and fall seasons. The fall season may be expanded into winter if dry conditions in fall and warm conditions in winter allow. If collection of storm events shall extend into fall/winter seasons beyond the WA PoP end date, collections will be dependent on the exercise of Option Period 1 and the issuance of a new Work Assignment. "Storm" event conditions shall be defined as precipitation of at least 0.75" in 48 hours or less resulting in increased flow in Congress Run. Should snow melt result in similar conditions to these for precipitation, a storm event sampling may be instigated. The goal is to collect representative samples for the rising limb, peak flow, and falling limb of each storm event captured and at each of the seven sampling locations for the study site. A total of 8 time points are to be collected for each storm event sampled and these will be collected at four sampling locations, B, E, F, and G.

Commented [CC1]: Are you referring to fall of 2016? And winter 2016/2017? The PoP of this WA ends on September 29, 2016. If this was your intention with these statements, I think we should include the following: ""

Storm or run-off generating events shall be sampled using ISCO automated sampling units. Where possible, flow-proportional sampling will be employed to capture the rising limb, peak flow, and falling limb of storm events and coordinated with gaging being installed on Congress Run at point E under a separate agreement with USGS. Where flow-proportional sampling is not possible, time-weighted sampling will be employed with an objective to collect similar time points during storm events at four locations; that being rising limb, peak flow, and falling limb of a hydrograph of each storm event. Data for this hydrograph will be provided in real time through the USGS web interface for gaging stations. Sample volumes collected shall be sufficient to provide for each of the analyses planned and temporary storage of an additional volume (20%) to

provide a back-up sample portion in case material is lost, a QC failure is encountered, or an analyte measurement must be repeated for any reason.

Analytes to be measured for storm or a run-off generating event sampling points shall include:

1. total suspended solids/volatile suspended solids (TSS/VSS),
2. suspended solids concentration (SSC),
3. metals and salts typical in urban runoff (e.g., Ca, Cd, Cu, Mg, Pb, Zn) (EPA Method 6010B/C),
4. chemical oxygen demand (COD),
5. biological oxygen demand (BOD),
6. density of traditional fecal indicator bacteria by Colilert method (total coliforms, *E. coli*),
7. total and dissolved nutrients (total nitrogen, ammonia, nitrate, nitrite, total phosphorus, total and dissolved reactive phosphorus [orthophosphate]),
8. total and dissolved organic carbon (TOC and DOC).

d. **YSI 6600 Sondes.** Sample collection for baseline and storm events will be augmented by real-time monitoring of specific water quality parameters by sondes installed and maintained at seven locations in Congress Run and the adjacent section of Mill Creek that relate to the proposed restoration. Nitratax probes shall be installed at three of these seven locations, at points B, C, and E. Monitoring at these locations will be continuous and will include the following biophysical parameters: pH, temperature, ORP, conductivity, dissolved oxygen, and chloride. These shall be measured using YSI 6600 sondes that are regularly calibrated and maintained. Calibration and maintenance of these sondes will be the responsibility of USEPA and will be performed on a schedule to allow PTSI to deploy and retrieve sondes at intervals expected to be between 2 and 4 weeks. The schedule for calibration and maintenance of these sondes shall be sufficient to ensure consistent data from each parameter meeting standard minimum quality control requirements and these will be established based on past experience on similar projects and described in the project QAPP.

e. **Nitratax probes**. In addition to the continuous data from the sondes described above, nitrate concentrations will be monitoring continuously using Nitratax probes at the three sampling locations in Congress Run, corresponding to points A, C, and E described above. Nitratax probes will require regular cleaning and calibration as per the manufacturer's standard protocols for these instruments which are accessible from the manufacturer (Hach).

f. **QA/QC**. The contractor shall establish and maintain strict quality assurance/quality control (QA/QC) parameters such as precision, accuracy, and method detection limits for each method and sonde or probe, providing a written

record for each method, data management support, and file archiving. The contractor shall flag instances where QC parameters for precision, accuracy and method detection limits fail so any associated data affected can be qualified, and will notify the EPA WACOR within 72 hours where QA/QC failures occur.

Quality Assurance

All research activities which generate data must follow the guidance of ORD policy and procedures manual section 13.4, *Minimum QA\QC Practices for ORD Laboratories Conducting Research*: PPM 13.4 Training.

Research records shall follow the applicable policy for laboratory notebooks, according to ORD policy and procedure manual section 13.2, *Paper Laboratory Records*: PPM 13.2 Training.
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When applicable, the contractor shall follow SOPs published by LRPCD at http://intranet.ord.epa.gov/p2/nrmrl/standard-operating-procedures-technical-lrpcd. As SOPs are revised and new SOPs are published, the list of approved SOPs changes, therefore it is important that SOPs published at this web location be consulted when referencing LRPCD SOPs.

The tasks and subtasks in this contract action identify QAPPs which will or may require revision. QAPP revisions must be reviewed and approved by the LRPCD QA manager before research begins under this work assignment.

Progress Meetings

The Contractor shall participate in monthly progress meetings, as requested, with the WACOR and shall provide information concerning the progress of laboratory activities, notify the WACOR of problems including QA/QC flags or failures, and review results. If appropriate, other EPA staff may attend these meetings at the request of the WACOR. The Contractor shall prepare summaries or minutes of these meetings and distribute to the WACOR.

Expected Outputs

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EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-55

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X To Option Period Number	Reactr Studs Eemrgign Contams

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	section 4 (a to e)

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

Period of Performance: From 09/30/2015 To 09/29/2016

Comments:
The contractor shall immediately start work on all tasks listed in the Work Assignment Performance Work Statement.

☐ 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 (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: To — 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 Carolyn Acheson	(Signature)	(Date)	Branch/Mail Code: Phone Number 513-569-7190 FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-569-7196 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 (PWS)
CONTRACT EP-C-15-010
PEGASUS TECHNICAL SERVICES, INC.

WORK ASSIGNMENT NUMBER: 0-55
WORK ASSIGNMENT TITLE: REACTOR STUDIES FOR EMERGING CONTAMINANTS

Period of Performance: September 30, 2015 through September 29, 2016
Site: On-Site

US EPA Work Assignment Contracting Officer Representative (WACOR):
Carolyn Acheson, 513.569.7190
US EPA Alternate WACOR:
Ronald Herrmann, 513.569.7741

Introduction

In the Land Remediation & Pollution Control Division (LRPCD), research on trace chemicals (also known as emerging contaminants) is focused in two areas: Endocrine Disrupting Chemicals (EDCs) and polyfluorinated compounds (PFCs). Research in this WA will characterize treatment in sewage related systems. Research will occur in 2 tasks:

Task 1 – Evaluating Biodegradation of PFCs
Task 2 – Study of Land Application of WWT Residuals

Explanations of the requirements and deliverables for each task follow.

This research shall be conducted in: rooms 424- 426, 425, 428-430, 436-432, and 438-442 of Andrew W. Briedenbach Environmental Research Center (AWBERC); at the wastewater treatment plant in Fairfield, OH; and at EPA's Chicago Regional Lab (CRL) in Chicago, IL. In addition, samples used in research may be collected at several local wastewater treatment plants. AWBERC equipment for this work assignment provided by the EPA includes chemical fume hoods, shakers, constant temperature boxes, centrifuges, weighing balances, drying ovens, stir plates, reactors, various extraction equipment, refrigerators, freezers, and other equipment as necessary. These spaces and equipment are often shared with other work assignments, grantees, and other federal staff. Contractor staff may be asked to sign up for this equipment or room space via a logbook or calendar system. The EPA WACOR should be informed of any difficulties associated with space or equipment. In some cases, the contractor may purchase lab supplies, as needed, after being approved by the COR and WACOR.

The building maintenance may affect lab activities. For example, hoods may be shutdown or constant temperature rooms may be unavailable. In addition, other projects may be added or moved from the labs the WA uses. When informed, the WACOR will notify staff of building maintenance and other activities which affect the work assignment. Contractor staff may be asked to move lab operations which would include moving equipment and lab supplies. These

activities should be conducted in accordance with Safety, Health and Environmental Management (SHEM) guidance (classroom training and website information).

This research shall be conducted according to NRMRL and Reg 5 CRL safety and health procedures, the NRMRL/LRPCD and Reg 5 CRL Quality Assurance system, and other LRPCD procedures such as LRPCD SOPs.

Communication and Dissemination – The contractor may be asked to support communication and dissemination activities related to this research. These activities could include: providing comments or suggestions on summaries of the research (hard copy or webpage) or handouts about the research; participating in lab tours of research; or contributing to video presentations of research. Research results may also be included in reports or papers submitted to peer-reviewed journals. It is difficult to anticipate research results and the number or content of these papers. As research proceeds, writing responsibilities will be assigned by the EPA WACOR via written technical direction. If the contractor will be assigned significant writing responsibilities, a work assignment amendment will be submitted prior to the beginning of writing.

Quality Assurance

All research activities which generate data must follow the guidance of ORD policy and procedures manual section 13.4, *Minimum QA\QC Practices for ORD Laboratories Conducting Research*: PPM 13.4 Training.

Research records shall follow the applicable policy for laboratory notebooks, according to ORD policy and procedure manual section 13.2, *Paper Laboratory Records*: PPM 13.2 Training. Copies of the current Quality Assurance policies may obtained here: Chapter 13 Policy and Procedures Manual.

When applicable, the contractor shall follow SOPs published by LRPCD at http://intranet.ord.epa.gov/p2/nrmrl/standard-operating-procedures-technical-lrpcd. As SOPs are revised and new SOPs are published, the list of approved SOPs changes, therefore it is important that SOPs published at this web location be consulted when referencing LRPCD SOPs.

Task 1 – Evaluating Biodegradation of PFCs

This work assignment supports Office of Research and Development (ORD) and Office of Pollution Prevention and Toxics (OPPT) efforts to evaluate the fate of PFC products in the environment. PFCs contribute to the observed environmental contamination by fluorotelomer alcohols (FTOHs) and perfluoroalkyl acids (PFAAs) such as perfluorooctanoic acid (PFOA). Under a previous WA, the fate of PFCs during aerobic biological treatment was evaluated. Reactors modeling wastewater treatment (WWT) units were used to evaluate the concentration of PFCs in biologically active WWT systems. The following subtasks will assist EPA in accomplishing this research:

Subtask 1A: Health and Safety
Subtask 1B: Documenting Evaluation of the inherent biodegradability of PFC chemicals in SCAS-based reactors

***Subtask 1A* –Health and Safety**

The contractor shall familiarize themselves with three Health and Safety Plans (HASPs): HASP 2012-082, HASP 2013-048, and HASP-2013-026. HASP 2013-026 describes safe practices for working with materials containing steroid hormones, Bisphenol A, and alkylphenol ethoxylates including sewage, and for performing the chemical analysis for these compounds. HASP 2013-048 discusses developing analytical methods to analyze samples for perfluorinated alkyl compounds, their precursors, and their degradates. These two HASPs are provided to the contractor for informational purposes. A third HASP, HASP 2012-082 for conducting tests of inherent degradability, is the primary HASP applicable to this task. The WACOR will supply a copy of the most recent versions of these HASPs. It is important that the contractor is familiar with these documents so that research can be conducted in a safe and consistent manner with attention to data quality. The contractor shall read the HASPs and conduct activities under this PWS in a manner consistent with the HASPs. These documents may be updated or adapted as part of this work assignment. The contractor may be asked to read and follow amendments prepared by others as well as amendments that they prepare.

The contractor shall read HASP 2012-082 and recommend changes based on their experience. The WACOR will review these suggestions and incorporate appropriate changes into a draft to be forwarded to SHEM. SHEM has offered to revise the HASP into their current format. The WACOR will forward the SHEM-revised HASP to the contractor. The contractor shall read the revised HASP prepared by SHEM and provide comments if the revisions do not reflect experimental plans and practices. These comments are due two weeks after the contractor receives the SHEM-revised HASP. The WACOR will read the SHEM-revised HASP and the contractors suggestions. The WACOR will provide comments to the contractor in writing, and the contractor shall revise the SHEM-revised HASP within 2 weeks of receiving the WACOR's comments. The contractor will send the revised HASP to the WACOR who will forward to SHEM for approval. If SHEM does not approve the HASP, another round of revision will occur. The WACOR will forward SHEM comments to the contractor, and the contractor will revise the HASP to respond to the comments within two weeks of receiving the comments in writing. The contractor will forward the HASP to the WACOR who will read it and forward it to SHEM if the revisions appropriately address the comments. It is anticipated that the second revision will be sufficient to obtain SHEM approval. Once the HASP has been approved by SHEM, all staff working on the HASP will be asked to read and sign the revised HASP demonstrating their agreement to follow the HASP. It should be noted that HASP revisions are not accepted until SHEM approves the HASP. HASP 2012-082 expires on Nov 30, 2015. All lab activities carried out under this HASP must be completed before HASP 2012-082 expires or must wait until the new HASP is in place.

If a new contractor staff member begins work under Task 1, the new staff member shall read the HASP prior to beginning work in the lab, and the staff member shall sign this document indicating that the HASP documents were read, understood, and will be followed. The contractor shall e-mail a copy of the concurrence page to the WACOR, with the new staff member's signature.

Because lab space is shared among many people, the contractor will be informed by the WACOR of other research occurring in the rooms in which they work. The WACOR will e-mail copies of the HASPs to the contractor's On Site Manager for distribution to relevant staff. Contractor staff may contact the WACOR with questions or concerns about these HASPs. If contractor staff notice work going on in a lab when they have not received a HASP, they should notify the WACOR by e-mail. The contractor may share HASPs with others, particularly others working in the labs where WA0-55 is active.

***Subtask 1B* – Documenting Evaluation of the inherent biodegradability of PFC chemicals in SCAS-based reactors**

In FY15, the inherent biodegradability of a PFC chemical was evaluated using a modified version of OPPTS 835.5045: Modified SCAS Test. This study followed QAPP L-21093-QP-1-0, Dosing of SCAS Reactors with PFOA, with a few changes. A data report was prepared based on this study. The WACOR will provide the contractor with this QAPP and data report. In FY16, the QAPP and the data report shall be revised.

For the QAPP, the WACOR will provide the contractor with a marked up version of the QAPP. Within 2 weeks of receiving the QAPP draft, the contractor shall read the QAPP and suggest changes to the WACOR. The WACOR will consider these changes as well as those from others, and provide a second marked up version to the contractor. Within 2 weeks of receiving the second QAPP mark-up, the contractor will revise the QAPP. The WACOR will submit the revised QAPP to the LRPCD Quality Assurance Manager (QAM), Jim Voit. When the QAM's QAPP review is available, the WACOR will forward the review to the contractor. Within 2 weeks of receiving the QAPP review, the contractor shall revise the QAPP based on the QAM review and WACOR written comments, and send the revised draft to the WACOR. The WACOR will send the revised draft to the QAM for another review. It is hoped that the second revision will be endorsed by the QAM. If additional revision is required, the WACOR will do it herself or amend the PWS.

Following completion of the FY15 SCAS test, a data package was prepared by the contractor consisting of a short description of materials and methods, summary of notable observations, and a copy of all data collected by the contractor. Any deviations from the QAPP were to be noted, including deviations from data quality goals. Data were to be presented in tabular and graphical forms. The QAPP provides a more detailed summary of the contents of the data report. For the data report, the WACOR will provide the contractor with written comments about changes to be made in the data report. If comments are not clear or the contractor has suggestions to improve

the report, they may request a meeting to discuss the report. The WACOR will provide a written summary of the meeting and of the changes to be made in the report. The contractor shall read the meeting summary and revise the data package within one month of receiving the summary.

Analysis of PFC samples from the FY15 SCAS test has not been completed. Contractor support shall be required to complete analysis of PFC samples following a CRL SOP similar to ASTM D7979-15. This work shall occur at CRL, and the contractor stationed at CRL shall follow their QA and safety procedures. Lawrence Zintek, Ph.D., of CRL, will be a technical advisor for this analysis.

The contractor shall participate in meetings with the WACOR to provide information concerning the progress of activities, notify the WACOR of problems or suggestions, and review results. If appropriate, other EPA staff may attend these meetings at the request of the WACOR. For example, the QAM may attend a meeting to discuss review of a QAPP. These meetings will occur at AWBERC. PTSI staff stationed in Chicago will be included by telephone. Informational meetings will occur no more than two times per month and last less than 2 hours each. A summary of the meeting will be available to document discussions.

Task 2 – Field Study on Land Application of WWT Residuals

In 2004 -2005, an EPA field study evaluated several aspects of the land application of WWT residuals including the chemical concentrations of alkyl phenol ethoxylates (APEs) in soil samples. While this study was useful, some questions remain regarding the removal of alkylphenol ethoxylates (APEs) following land application, and it would be helpful to know about the concentrations and fate of other chemicals such as PFCs. In FY15, a pilot scale study was started to gain more information to answer these questions at Fairfield Wastewater Treatment plant, Fairfield, OH. Under a previous contract, a HASP (HASP 2013-018) and QAPP (L-20711-QP-1-1) describing the field scale study on land application of biosolids was approved by SHEM and the LRPCD QAM, respectively. These documents will be supplied to the contractor by the WACOR. The following subtasks will assist EPA in accomplishing this research:

Task 2A – Health and Safety
Task 2B – Conduct research outlined in the QAPP

Task 2A – Health and Safety

The contractor shall familiarize themselves with three Health and Safety Plans (HASPs): HASP 2013-026, HASP 2013-048, and HASP-2013-018. HASP 2013-026 describes safe practices for working with materials containing steroid hormones, Bisphenol A, and alkylphenol ethoxylates including sewage, and for performing the chemical analysis for these compounds. HASP 2013-048 discusses developing analytical methods to analyze samples for perfluorinated alkyl compounds, their precursors, and their degradates. These two HASPs are provided to the contractor for informational purposes. HASP 2013-018 describes the field and microcosm scale

study on land application of biosolids and was approved by SHEM. The contractor shall read the HASPs and conduct activities under this PWS in a manner consistent with the HASPs. It is important that the contractor is familiar with these documents so that research can be conducted in a safe and consistent manner with attention to data quality.

The next sample day for this experiment is Oct 5, 2015, weather permitting. The contractor shall participate in sampling as described in the HASP and QAPP. All contract staff participating in sampling must read and agree to follow the HASP. The contractor shall document concurrence with the HASP by sending an e-mail to the WACOR with a signed concurrence sheet for all staff participating in the sample event.

The annual review for this HASP is due on October 30, 2015. By Oct 9, 2015, the contractor shall provide comments to the WACOR regarding revisions needed in the HASP. If the contractor does not notice omissions or discrepancies between the HASP and research practices, an e-mail explaining this observation should be sent to the WACOR. The WACOR will decide if revision is required. If required, the WACOR will submit a marked up version of the HASP to the contractor. The contractor shall revise the HASP within 2 weeks of receiving the WACOR's marked up copy. The contractor will send the revised HASP to the WACOR who will review it and then send it to SHEM for approval. If SHEM does not approve the HASP, another round of revision will occur. The WACOR will forward SHEM comments to the contractor, and the contractor will revise the HASP to respond to the comments within two weeks of receiving the comments in writing. The contractor will forward the HASP to the WACOR who will read it and forward it to SHEM if the revisions appropriately address the comments. It is anticipated that the second revision will be sufficient to obtain SHEM approval. Once the HASP has been approved by SHEM, all staff working on the HASP will be asked to sign the revised HASP demonstrating their agreement to follow the HASP. It should be noted that HASP revisions are not accepted until SHEM approves the HASP revision.

If a new contractor staff member begins work under Task 2, that new staff member shall read the HASP prior to beginning work on the task. The new contractor staff member shall sign a concurrence document explaining that the HASP documents were read, understood, and will be followed. The contractor shall e-mail the WACOR informing of them of the staff and attaching a copy of the concurrence document.

Because lab space is shared among many people, the contractor will be informed by the WACOR of other research occurring in the rooms in which they work. The WACOR will e-mail copies of the HASPs to the contractor's On Site Manager for distribution to relevant staff. Contractor staff may contact the WACOR with questions or concerns about these HASPs. If contractor staff notice work going on in a lab when they have not received a HASP, they should notify the WACOR by e-mail. The contractor may share HASPs with others, particularly others working in the labs where WA3-55 is active.

<u>Task 2B</u> - Conduct research outlined in the QAPP

QAPP (L-20711-QP-1-1) describing the field scale study on land application of biosolids was endorsed by the LRPCD QAM. Prior to participating in research on this WA, the contractor shall read the QAPP and conduct experiments as described by the QAPP. This research shall be conducted in manner which is consistent with the QA procedures of LRPCD. The contractor shall submit a document listing all staff currently working on Task 2 to the WACOR. Each staff member shall sign this document indicating that the QAPP has been read, understood, and will be followed. A similar procedure will be followed for QAPP amendments or revisions. When annual review of the QAPP is due, the contractor shall submit a document noting that current lab activities are described by the QAPP or identifying differences between current lab activities and the QAPP. Finally, if a new contractor staff member begins work under Task 2, that new staff member shall read the QAPP prior to beginning work in the lab. The new contractor staff member shall sign a concurrence document indicating that the QAPP documents were read, understood, and will be followed. The contractor shall submit a document to the WACOR including the concurrence document.

Currently, samples will be collected at 2 sample events in FY16. The study consists of 12 field scale plots. As specified in the QAPP, the contractor shall assist in preparing sampling supplies, collecting samples, mixing samples, and distributing samples to others for analysis, including preparing samples for shipment to other locations. The contractor shall analyze samples for routine measurements such as moisture content as specified in the QAPP. The PLFA/FAME measurements for this study will be conducted as part of WA 0-59 (Ronald Herrmann WACOR). As described in the QAPP, analytical activities for APEs and some PFC samples will occur in Chicago at CRL. The contractor will supply laboratory staff to extract and analyze samples for APEs and PFCs by LC/MS/MS following CRL SOPs. Lawrence Zintek, Ph.D., of CRL will be a technical advisor for APEs and PFC analysis.

The final deliverable for this task is a data package which shall be prepared by the contractor consisting of a short description of materials and methods, summary of notable observations and a copy of all data received or collected by the contract on this task. Any deviations from the QAPP shall be noted, including deviations from data quality goals. Data shall be presented in tabular forms. The contractor will receive data from collaborators from the EPA WACOR. The contractor is not responsible for data analyzed by non-PTSI staff. Collaborator data received at least two weeks prior to the due date of the data package shall be compiled in the data package. The data package consists of a collection of electronic files located on the L drive as described in the QAPP. The electronic data package shall include the raw data files and the processed data files collected by the contractor. The draft data package is due 2 months after the final sample event. The WACOR will review the data package and may request a revision if information is missing or unclear. The WACOR will provide written comments to be incorporated into a revised data package. The revised data package will be due one month after comments are received.

The contractor shall participate in meetings with the WACOR to provide information concerning the progress of laboratory activities, notify the WACOR of problems, and review results. If appropriate, other EPA staff or may attend these meetings at the request of the WACOR. For

example, the QAM may attend a meeting to discuss review of a QAPP. These meetings will occur at the AWBERC. Informational meetings will occur about twice per month and last about 2 hours each. A summary of the meeting will be available to document discussions.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-55

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	09/30/2015 To 09/29/2016 Base X Option Period Number	Reactr Studs Emerging Contams

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	section 4 (a to e)

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

Period of Performance: From 09/30/2015 To 09/29/2016

Comments:
The funding ceiling is increased to $73,000, the contractor shall not exceed the funding ceiling until amended by the Contracting Officer.

☐ 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: 09/30/2015 To 09/29/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Carolyn Acheson	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7190 FAX Number:
Project Officer Name Michael Moeykens	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7196 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:

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-55

☐ Other ☒ Amendment Number: 000002

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	09/30/2015 To 09/29/2016 Base X Option Period Number	Reactr Stud Emerging Contams

Contractor: PEGASUS TECHNICAL SERVICES, INC.

Specify Section and paragraph of Contract SOW: section 4 (a to e)

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

Period of Performance: From 09/30/2015 To 09/29/2016

Comments:
The purpose of this amendment is to increase the funded ceiling to the work plan approved amount.

☐ 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
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Authorized Work Assignment Ceiling

Contract Period: 09/30/2015 To 09/29/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Carolyn Acheson (Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7190 FAX Number:	
Project Officer Name Michael Moeykens (Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7196 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:	

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-55

☐ Other ☒ Amendment Number: 000003

Contract Number: EP-C-15-010

Contract Period: 09/30/2015 To 09/29/2017

Base X Option Period Number

Title of Work Assignment/SF Site Name: Reactr Studs Emerging Contams

Contractor: PEGASUS TECHNICAL SERVICES, INC.

Specify Section and paragraph of Contract SOW: section 4 (a to e)

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

Period of Performance: From 09/30/2015 To 09/29/2016

Comments:
The purpose of this amendment is to add a new task.

☐ 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
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Authorized Work Assignment Ceiling

Contract Period: 09/30/2015 To 09/29/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name: Carolyn Acheson
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-569-7190
FAX Number:

Project Officer Name: Michael Moeykens
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-569-7196
FAX Number:

Other Agency Official Name: Dennis Timberlake
(Signature) (Date)
Branch/Mail Code:
Phone Number: 513-569-7547
FAX Number:

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

PERFORMANCE WORK STATEMENT (PWS)
CONTRACT EP-C-15-010

WORK ASSIGNMENT NUMBER: 0-55, AMENDMENT 3
WORK ASSIGNMENT TITLE: REACTOR STUDIES FOR EMERGING CONTAMINANTS

Period of Performance: September 30, 2015 through September 29, 2016
Site: On-Site

US EPA Work Assignment Manager (WACOR): Carolyn Acheson, 513.569.7190
US EPA Alternate WACOR: Ronald Herrmann, 513.569.7741

Purpose

The purpose of this amendment is to add a new task to the work assignment. The contractor shall provide support to Chicago Regional Laboratory (CRL) in analyzing samples from contaminated sites for poly- and perfluorinated alkyl substances (PFASs), as well as some related activities. All other activities and deliverables remain the same.

Task 3 – Analyzing samples for PFASs from contaminated sites

The contract shall assist CRL in analyzing samples from contaminated sites such as Resource Conservation and Recovery Act (RCRA), Superfund, and similar sites for PFASs. These sites may be associated with current or former military bases, manufacturing facilities, fire training areas, airports, or industrial sites. Three subtasks are included in this task.

Subtask 1. ASTM standards (ASTM 7968-14 and ASTM 7979-15) are being revised to include about 10 additional analytes. The contractor shall assist with this revision and complete an Analyst Demonstration of Capability (ADOC) when the revised standards are completed.

Subtask 2. PFAS concentrations in approximately 60 samples of either soil or water will be measured. The contractor shall assist the technical advisor, Larry Zintek, in analyzing these samples in coordination with the EPA WACOR.

Subtask 3. Assist CRL in developing ASTM standards for PFAS precursors and transformation products. Under WA 0-10, a GC/MS/MS method has been developed to analyze soil and water samples for perfluorinated alkyl acid (PFAAs) precursors and transformation products of the pathway which produces PFAAs. These precursors and transformation products include chemicals such as fluorotelomer acids (FTOHs), N-ethyl perfluorooctane sulfonsmidoethanol (EtFOSE), N-methyl perfluorooctane sulfonsmidoethanol (MeFOSE), and N-ethyl perfluorooctane sulfonsamide (EtFOSA). The EPA would like the current methods to be revised to submit to ASTM for consideration as a standards. The contractor shall provide assistance with these revisions.

The contractor shall participate in meetings with the WACOR to provide information concerning the progress of activities, notify the WACOR of problems or suggestions, and review results. If appropriate, other EPA staff may attend these meetings at the request of the WACOR. For example, the QA Manager may attend a meeting to discuss review of a QAPP. These meetings will occur at AWBERC. Any contractor staff stationed in Chicago will be included by telephone. Informational meetings will occur no more than two times per month and last less than 2 hours each. A summary of the meeting will be available to document discussions.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-57

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X To Option Period Number	Wetland Hydrol Nutrient Model

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	4(G), GIS and modeling support

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

Period of Performance: From 11/04/2015 To 09/29/2016

Comments:
The contractor shall immediately start work on all tasks listed in the Work Assignment Performance Work Statement.

☐ 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 (Max 7)
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Authorized Work Assignment Ceiling

Contract Period: To — 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 Mohamed Hantush	(Signature)	(Date)	Branch/Mail Code: Phone Number 513-569-7089 FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-569-7196 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:

CONTRACT EP-C-15-010
Work Assignment 0-57
Performance Work Statement

Wetland Hydrology and Nutrient Modeling

Work Assignment Contracting Officer's Representative (WACOR):
Mohamed Hantush 513-569-7089

Alt. WACOR:
Stephen Wright 513-569-7610

Period of Performance: CO Issuance to September 29, 2016

The National Risk Management Research Laboratory (NRMRL) is the principal entity within U.S. EPA and the Office of Research and Development (ORD) responsible for environmental and engineering risk management research. Development of approaches and modeling tools and application thereof to the management of water quality and ecosystems in multiple land-use watersheds and at multiple scales is one critical research area. This research contract lends assistance to research on wetland and riparian zone nutrients and carbon function modeling for sustainable water resources management conducted by the Environmental Stressors Management Branch (ESMB), Land Remediation and Pollution Control Divisions and National Risk Management Research Laboratory (NRMRL), Office of Research and Development (ORD), United States Environmental Protection Agency (U.S. EPA).

Background:

Wetlands are ecotones transitional between terrestrial ecosystems and aquatic ecosystems. There is mounting evidence that wetlands are capable of retaining and/or reducing sediment and nutrient loadings. In addition to treating runoff, wetland ecosystems ameliorate floods and droughts and provide biodiversity and habitat benefits as well as other water quality functions. In conjunction with the increasingly adopted low intensity developments/Green Infrastructure (LIDs/GIs) and traditional abatement technologies and best management practices (BMPs), these ecosystems, depending on their characteristics and location in watersheds, could be used to remove pollutants from runoff and generate pollutant-reduction credits.

In previous work assignments under EPC11006, Dr. Hantush of EPA and Dr. L. Kalin of Auburn University developed and successfully applied a nutrient (nitrogen and phosphorus) wetland model to wetland data collected from two cites obtained in collaboration with the Smithsonian Institute (Hantush et al., 2013; and Kalin et al., 2013). The wetland model was modified for carbon sequestration (Sharifi et al., 2013) and expanded to allow for lateral and vertical mass exchanges with stagnant (immobile) zones in the water column (Sharifi et al., 2015). This work assignment will continue further

refinement of the subsurface hydrology component of the model. The model will be applied to simulate wetland nutrient function of three wetlands using hydrologic and water quality collected across a gradient of urban land uses.

In addition to riparian buffer zones and wetlands, Low Impact Developments (LIDs) and Green Infrastructure (GI) are increasingly being relied upon as integral elements of urban planning and for flood control and treatment of polluted urban runoff. This work assignment will also explore the compilation of groundwater database including nutrient levels monitored in groundwater wells tapping Baldwin County, AL. The database shall form the basis for modeling potential impact of wetlands and LIDs/GIs on groundwater quality at multiple scales.

Scope of Work:

The scope of this work is modeling hydrology and nutrient function of wetland nutrient function in coastal urban watersheds in Alabama. This work will also explore development of hydrologic and groundwater database to model potential impacts of wetlands and LIDs/GIs on groundwater quality.

Objectives:

The objectives of this work assignment are: (1) validate unsaturated flow model developed by the EPA WACOR; (2) calibrate and apply the model to assess nutrient performance of three wetlands using hydrologic and water quality data from wetlands chosen along a gradient of urban modifications in Baldwin County, AL; and (3) develop database needed to assess and model potential impact of wetlands and LIDs/GIs on groundwater quality in coastal Alabama.

Task 1: Modification of the wetland model

The contractor shall compare a depth-averaged unsaturated flow model developed by the EPA WACOR to a numerical of Richard's equation for a variety of boundary conditions.

The contractor shall modify QA Project Plan (L17731-QP-1-1, Wetland Nutrients and Carbon Cycling Modeling) for the new unsaturated flow model and for application of the wetland model to case-study wetlands in Baldwin County, AL (Task 2). The contractor shall prepare the QAPP to reflect current LRPCD format. LRPCD QAPP templates in the current QAPP format will be provided by the WACOR or the LRPCD QA manager. The QAPP will be reviewed by EPA Quality Assurance Manager and, if necessary, shall be revised by the contractor.

The contractor shall coauthor a journal article with the EPA WACOR on the WetQual model modifications within 6 months from the work assignment issuance.

Task 2: Application of Wetland Model to Wetlands in Baldwin County, AL

The contractor shall calibrate and validate WetQual for flow and nutrient data in three case-study wetlands in Baldwin County, AL. If necessary, the contractor shall use proper modeling methodology (data-driven or SWAT model) to simulate groundwater contributions to the wetlands. The contractor shall use the calibrated wetland models to predict nutrient function the wetlands chosen across a gradient of urban modifications; i.e., high to low level of urban development within their catchments.

The contractor shall coauthor a journal article with the EPA WACOR on model applications to the case-study wetlands in Baldwin County, AL, within 6 months from the WA issuance date.

Task 3: Compilation of hydrogeologic, groundwater nutrients, LIDs/GIs database in Baldwin County

The contractor shall coordinate efforts with local, state, and federal government agencies to develop a comprehensive database on the hydrogeology, nutrients' concentrations in groundwater wells, wetlands, and LIDs/GIs in coastal Alabama (e.g., Baldwin County). The database shall specifically include the type and geometric and performance characteristics of LIDs/GIs including wetlands in close proximity to groundwater wells; hydrogeologic data, including geophysical logs, hydrostratigraphy, aquifer recharge, and aquifer hydraulic properties, among others.

The contractor shall develop a shared-access website for storage and management of dataset within 12 months from the WA issuance. The complete database shall be delivered in electronic storage media.

Quality Assurance

All research activities which use or produce models must follow the guidance of ORD policy and procedures manual section 13.9, *Modeling Quality Assurance and Documentation*: ORD PPM 13.9.

ORD PPM 13.9

Research records shall follow the applicable policy for laboratory notebooks, according to ORD policy and procedure manual section 13.2, *Paper Laboratory Records*.

Copies of the current Quality Assurance policies may obtained here: Chapter 13 Policy and Procedures Manual.

The tasks and subtasks in this work assignment identify QAPPs which will or may require

revision. QAPP revisions must be reviewed and approved by the LRPCD QA manager before research begins under this work assignment.

References:

Sharifi, A., L. Kalin, M. M. Hantush. 20015. "Capturing spatial variability of concentration and reaction rates in wetland water and soil through model compartmentalization." J. Hydrol. Engrng. DOI: 10.1061/(ASCE)HE.1943-5584.0001196.

Sharifi, A., L. Kalin, M.M. Hantush, S. Isik, T.E. Jordan. 2013. Carbon dynamics and export from flooded wetlands: A modeling approach. *Ecol. Model*, 263, 196-210.

Kalin, L., M.M. Hantush, S. Isik, A. Yucekaya, T. Jordan. 2013. Nutrient Dynamics in Flooded Wetlands: II. Model Application. *Journal of Hydrologic Engineering*, doi:10.1061/(ASCE)HE.1943-5584.0000750.

Hantush, M.M., L. Kalin, S. Isik, A. Yucekaya. 2013. Nutrient Dynamics in Flooded Wetlands: I. Model Development. *Journal of Hydrologic Engineering*, doi:10.1061/(ASCE)HE.1943-5584.0000741.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-59

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	To	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X	Option Period Number	Provide Lab support for FAME

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	section 4-B+E+H

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

Period of Performance: From 09/30/2015 To 09/29/2016

Comments:
The contractor shall immediately start work on all tasks listed in the Work Assignment Performance Work Statement.

☐ 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 (Max 7)
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Authorized Work Assignment Ceiling

Contract Period: To — 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 Herrmann	(Signature)	(Date)	Branch/Mail Code:
			Phone Number 513-569-7741
			FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7196
			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
PEGASUS TECHNICAL SERVICES, INC.
CONTRACT NO. EP-C-15-010

WORK ASSIGNMENT NUMBER: WA 0-59

PERIOD OF PERFORMANCE: September 30, 2015 THROUGH SEPTEMBER 29, 2016

PROVIDE LABORATORY SUPPORT FOR FAME AND ENDOTOXIN RESEARCH PROJECTS.

U.S. EPA Work Assignment Contracting Officer's Representative: Ronald Herrmann 513.569.7741
U.S. EPA Alternate Work Assignment Contracting Officer's Representative: Joseph Schubauer-Berigan 513.569.7734

INTRODUCTION

This Work Assignment will provide services for laboratory research activities dealing with microbial and physical aspects of biosolid waste research within the Land Remediation and Pollution Control Division, whose mission is:

Conducting research at the basic level, as well as bench- and pilot-scale levels, to explore innovative solutions to current and future land pollution problems.

PROPOSED RESEARCH UNDER WORK ASSIGNMENT WA 0-59

The following list of Tasks shall be performed under this Work Assignment. Each Task will be described in additional detail on the following pages.

Task A	FAME (fatty acid methyl ester) Laboratory Support Functions
Task B	Field Study on Land Application of WWT Residuals

TASK A

FAME (fatty acid methyl ester) Laboratory Support Functions

1. Review
The contractor shall provide laboratory services for processing environmental samples from various QAPPs and preliminary studies through the FAME analysis method. This method is defined in the SOP of Internal NRMRL Procedures as NRMRL-LRPCD-20-0 Fatty Acid Methyl Ester (FAME) Analysis by Gas Chromatography with Flame Ionization Detection. The method consists of organic extraction of samples, isolation of phospholipids by SPE, methylation of phospholipid fatty acids, purification of FAMEs

and running a GC FID. The contractor shall also perform data manipulation for formatting purposes.

2. Work / Experimental Requirements:

a) The contractor shall prepare materials for general laboratory use: clean glassware, standards preparation, column packing, and basic equipment maintenance. Maintain all Lab space in compliance with the buildings current Chemical Hygiene Plan (available from the EPA WACOR).

b) The contractor shall prepare laboratory notebooks and instrument logs detailing chemical and analytical processes in accordance with LRPCD laboratory protocols and QA/QC procedures.

c) The contractor shall prepare and process all samples received by the SOP for FAME Analysis. The method will be provided to the contractor and training provided. Work to be performed in accordance with the current revision of 'Land Application of Biosolids' QAPP (ID # will be provided by the EPA WACOR).

d) The contractor shall prepare assistance in reviewing and writing QAPPs, HASPs, SOPs, and reports for projects that require FAME analysis. Meetings will be held monthly (or as needed) to discuss ongoing work.

3. Expected Outputs:

a) The contractor shall maintain the lab in a clean and orderly fashion. The lab should be able to begin processing samples as they arrive.

b) The contractor shall provide email notification to WACOR when samples are received. The contractor shall maintain lab books and sample log sheets for sample process identification.

c) The contractor shall process all samples according to the SOP defined above. FAME data from the GC FID will be sorted in Excel and provided to the WAM.

d) Monthly meetings and finalized QAPPs, HASPs and reports.

TASK B

Field Study on Land Application of WWT Residuals

1. Review

In 2004 -2005, a field study evaluated the chemical concentrations of alkyl phenol ethoxylates (APEs) following land application of WWT residuals. While this study was useful, some questions remain regarding the removal of alkylphenol ethoxylates (APEs) following land application, and it would be helpful to know about the concentrations and fate of other chemicals such as steroid hormones and PFCs. Under task 2(c), a study will be conducted to gain more information to answer these questions. The current study is

occurring at Fairfield Wastewater Treatment plant, Fairfield, OH. There are three more sampling events that will occur.

2. Work / Experimental Requirements:

a) The contractor shall prepare materials for general laboratory use: clean glassware, standards preparation, and basic equipment maintenance. Maintain all Lab space in compliance with the buildings current Chemical Hygiene Plan.

b) The contractor shall prepare laboratory notebooks and instrument logs detailing sample receiving and analytical processes in accordance with LRPCD laboratory protocols and QA/QC procedures.

c) Assist in preparation of data and writing of manuscripts.

3. Expected Outputs:

a) The lab should be maintained in a clean and orderly fashion. The lab should be able to receive samples, log them in, and begin processing samples as they arrive.

b) Email notification to WACOR when samples are received. Contractor shall maintain lab books and sample log sheets for sample process identification.

c) All samples will be processed according to the SOP defined above. FAME data from the GC FID shall be sorted in Excel and provided to the WAM.

d) Monthly meetings and finalized QAPPs, HASPs and reports.

Quality Assurance

All research activities which generate data must follow the guidance of ORD policy and procedures manual section 13.4, *Minimum QA\QC Practices for ORD Laboratories Conducting Research*: PPM 13.4 Training.

Research records shall follow the applicable policy for laboratory notebooks, according to ORD policy and procedure manual section 13.2, *Paper Laboratory Records*: PPM 13.2 Training.

Copies of the current Quality Assurance policies may obtained here: Chapter 13 Policy and Procedures Manual.

When applicable, the contractor shall follow SOPs published by LRPCD at http://intranet.ord.epa.gov/p2/nrmrl/standard-operating-procedures-technical-lrpcd. As SOPs are revised and new SOPs are published, the list of approved SOPs changes, therefore it is important that SOPs published at this web location be consulted when referencing LRPCD SOPs.

The tasks and subtasks inn this contract action identify QAPPs which will or may require revision. QAPP revisions must be reviewed and approved by the LRPCD QA manager

before research begins under this work assignment.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-61

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	To	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X	Option Period Number	Environmental Stressor Studies

Contractor: PEGASUS TECHNICAL SERVICES, INC.

Specify Section and paragraph of Contract SOW: section 4-B=E=H

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

Period of Performance: From 10/09/2015 To 09/29/2016

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 (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: To — 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 Herrmann	(Signature)	(Date)	Branch/Mail Code:
			Phone Number 513-569-7741
			FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7196
			FAX Number:
Other Agency Official Name Maxanne Baldwin	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7962
			FAX Number:
Contracting Official Name Candice Charlton	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-487-2007
			FAX Number:

Performance Work Statement
PEGASUS TECHNICAL SERVICES, INC.
CONTRACT NO. EP-C-15-010

WORK ASSIGNMENT NUMBER: WA 0-61

PERIOD OF PERFORMANCE: CO ISSUANCE THROUGH SEPTEMBER 29, 2016

Environmental Stressor Studies Support

U.S. Work Assignment Contracting Officer's Representative (WACOR):
Ronald Herrmann, (513) 569-7741
U.S. EPA WACOR:
Joe Schubauer-Berigan (513) 569-7734

INTRODUCTION

This Work Assignment will provide support for research activities within the Environmental Stressors Management Branch whose mission is:

To develop better ways to manage water pollution on a watershed-scale basis. By understanding how anthropogenic changes to upland environments result in specific identifiable stresses on land and associated receiving water bodies, and develop appropriate management practices that will minimize the damage that these biological, physical and chemical stressors can cause. Focus areas for our research are point sources, such as wastewater treatment plants, landfills, Concentrated Animal Feeding Operations (CAFOs), and non-point sources; such as land use (including new green infrastructure and sustainable design initiatives), biosolids, and suburban development resulting in stressors such as nutrients, sediments, metals and other contaminants. This work assignment will also address emergent issues and innovation initiatives.

RESEARCH UNDER WORK ASSIGNMENT WA 0-61

The following list of Tasks shall be performed under this Work Assignment. Each Task will be described in additional detail on the following pages. Each Task may require some travel for site visits or limited sampling support. ***For monthly progress reports, the WACOR requests that project expenses be separated according to task to allow for improved project tracking.***

Task A Chemical and Biological Methods and Analytical Instrument Support for Laboratory and Field Applications
Task B Laboratory and Field Sampling Support, Data Collection, and Analysis

TASK A

CHEMICAL AND BIOLOGICAL METHODS AND ANALYTICAL INSTRUMENT SUPPORT FOR LABORATORY AND FIELD APPLICATIONS

1. Background and Objectives

LRPCD has initiated watershed/landscape ecology studies to develop and evaluate risk management approaches for point and non-point pollutants including bacteria, pathogens, sediments, and nutrients. Pathogens of concern include bacteria, viruses, and parasites commonly found in detectable concentrations in wastewater treatment plant effluents, biosolids, landfills, residuals from Concentrated Animal Feeding Operations (CAFOs), and non-point sources associated with human activity such as land use practices; including new green infrastructure and sustainable design initiatives, biosolids application, and suburban development resulting in stressors such as nutrients, sediments, metals and other contaminants. The watershed pollutants from these varied sources and activities are important in assessing ecosystem function, water quality, and management approaches for land and aquatic resources (including total maximum daily loads (TMDLs), best management practices, green infrastructure, etc.). The above studies will be carried out through a combination of contractor support and in-house personnel. Important components of this work include sampling and analytical support (using established SOPs or newly developed methods) for laboratory and field settings, and characterization of various biological and chemical constituents of interest in laboratory samples (possibly produced from experiments) and environmental matrices.

Development of new or additional biological or chemical analytical instrumentation SOPs may be necessary under this Task.

2. Prepare/ Revise Health and Safety Plans (HASPs)

The Contractor shall prepare new, and revise existing HASPs (to be provided by the WACOR) as needed, (if additional SOPs are developed for this research) incorporating the comments of the WACOR and Safety Office within 2 weeks of receiving the comments. The final amended HASPs shall be submitted to the WACOR. Once the HASPs have been endorsed by the WACOR and the Safety staff, research can proceed. The Contractor shall conduct field and laboratory work in a manner consistent with the HASPs, and according to NRMRL safety and health procedures. Both the WACOR and Safety Office will review any new or modified HASPs.

3. Quality Assurance Project Plan

It is unlikely that new QAPP(s) will be required for this task. Where feasible, existing QAPPs (to be provided by the WACOR) will be used for analysis of environmental samples (water and soil) and incorporated into QAPP documents on a project-by-project basis. In the event that new QAPP(s) or a modification of existing QAPPs are required, the Contractor shall prepare new or revise existing QAPPs as needed, incorporating the comments of the WACOR and appropriate QA staff within 2 weeks of receiving the comments. The final amended QAPP(s) shall be submitted to the WACOR. Once the QAPP(s) has been endorsed by the WACOR and the QA staff, research can proceed. The

Contractor shall conduct field and laboratory work in a manner consistent with the QAPP(s), and according to NRMRL QA procedures. Both the WACOR and Quality Assurance Manager (QAM) will review any new or modified QAPP(s).

4. Work / Experimental Requirements:
The contractor shall:
a) Sample and analyze various environmental matrices in laboratory and field settings for desired biological and chemical constituents, and provide detailed analytical results and QA/QC data on a project-by-project basis. Use established or newly developed SOPs for various environmental matrices including, but not limited to water, soil and sediment, sludge/biosolids, and liquid extracts collected on a variety of media as provided in written technical direction issued by the WACOR.

Development of new or additional biological or chemical analytical instrumentation SOPs may be necessary under this Task.

b) Conduct routine maintenance and support to keep sampling and analytical instruments operable, including: cleaning, instrument calibration, maintenance, and upgrades, management of consumable supplies and chemicals associated with analyses, and data management and file archiving. *Purchase consumables supplies as needed to maintain continuity and quality of samples and analyses.*

c) Establish and maintain strict quality assurance / quality control (QA/QC) parameters such as precision, accuracy, and method detection limits for each sampling and analytical instrument and method, providing a written record for each instrument and method, data management support, and file archiving.

d) Develop new SOPs, HASPs, and QAPPs as needed, and update existing SOPs, HASPs, and QAPPs (according to LRPCD format) to address sampling and analysis of environmental matrices (soils, sediments, organic matter such as plant or animal tissue) using the appropriate sampling and analytical instrumentation methods for the matrices as provided in written technical direction issued by the WACOR.

5. Progress Meetings:
The Contractor shall participate in progress meetings, as requested, with the WACOR to provide information concerning the progress of laboratory activities, notify the WACOR of problems, and review results. If appropriate, other EPA staff may attend these meetings at the request of the WACOR. Meetings will be held with the WACOR as often as needed. Initial meetings shall be needed with the Contractor's On-Site technical manager or Team Leaders to ensure that the analyses requested will answer the project goals.

6. Expected Outputs:
a) Individual project analytical data will be tailored to each project. In most cases the expected data will take the form of electronic records in a format suitable for further

manipulation (Excel or specific instrument software packages (e.g., Beckman-Coulter LS230, YSI 6600 data). QA/QC data will be included with each report.

b) Laboratory notebooks and instrument logs detailing chemical and analytical processes in accordance with LRPCD laboratory protocols and QA/QC procedures (to be provided by the WACOR).
c) Analysis and reporting based on project data may be required, but will be determined on a project by project basis. If project reports are requested, they will be provided in a format acceptable to the WACOR for the specific project. In general, these reports will follow the accepted EPA numbered report format as used by NRMRL/LRPCD. An example is available at: http://www.epa.gov/nrmrl/pubs/600r10126/600r10126.pdf

7. Comments
Potential Rooms/Labs: AWBERC B2-B6, 401-403,404-409, 424-430, 432-436, 438-442, 701-704, 708, 715, 720-722, 729 and FCF Room 108.

Laboratory instruments include: Shimadzu TOC/TNM/SSM, SEAL Analytical Colorimetric Analyzer and Beckman-Coulter LS230. New instrumentation for FY16 includes the DGA-MIMS gas analyzer, and others as required on a project by project basis.

Field equipment and instruments include: YSI DO Meters and 6600 Multi-Parameter Water Quality meters/sondes, ISCO automated water samplers, In-Situ level loggers, Rickly stream discharge meters, equipment for measuring stream re-aeration, portable weather stations, and a variety of field portable instruments to determine soil and water parameters, and global position (GPS) and various other field equipment as provided in written technical direction provided by the WACOR.

TASK B

LABORATORY AND FIELD SAMPLING SUPPORT, DATA COLLECTION, AND ANALYSIS

1. Project Background
LRPCD has initiated watershed/landscape ecology studies to develop and evaluate risk management approaches for point and non-point pollutants including bacteria, pathogens, sediments, and nutrients. Pathogens of concern include bacteria, viruses, and parasites commonly found in detectable concentrations in wastewater treatment plant effluents, biosolids, landfills, residuals from Concentrated Animal Feeding Operations (CAFOs), and non-point sources associated with human activity such as land use practices; including new green infrastructure and sustainable design initiatives, biosolids application, and suburban development resulting in stressors such as nutrients, sediments, metals and other contaminants. The watershed pollutants from these varied sources and activities are important in assessing ecosystem function, water quality, and management approaches for land and aquatic resources (including total maximum daily loads (TMDLs), best management practices, green infrastructure, etc.). The above studies will

be carried out through a combination of contractor support and in-house personnel. Important components of this work include laboratory and field sampling and support (using established SOPs or newly developed methods) for biological and chemical constituents of interest in laboratory samples (possibly produced from experiments) and environmental matrices.

Laboratory and field and sampling and support using established SOPs or newly developed methods should be completed under this Task.

2. Prepare/ Revise Health and Safety Plans (HASPs)
The Contractor shall prepare new, and revise existing HASPs (to be provided by the WACOR) as needed, (if additional SOPs are developed for this research) incorporating the comments of the WACOR and Safety Office within 2 weeks of receiving the comments. The final amended HASPs shall be submitted to the WACOR. Once the HASPs have been endorsed by the WACOR and the Safety staff, research can proceed. The Contractor shall conduct field and laboratory work in a manner consistent with the HASPs, and according to NRMRL safety and health procedures. Both the WACOR and Safety Office will review any new or modified HASPs.

3. Quality Assurance Project Plan
It is unlikely that new QAPP(s) will be required for this task. Where feasible, existing QAPPs (to be provided by the WACOR) will be used for analysis of environmental samples (water and soil) and incorporated into QAPP documents on a project-by-project basis. In the event that new QAPP(s) or a modification of existing QAPPs are required, the Contractor shall prepare new or revise existing QAPPs as needed, incorporating the comments of the WACOR and appropriate QA staff within 2 weeks of receiving the comments. The final amended QAPP(s) shall be submitted to the WACOR. Once the QAPP(s) has been endorsed by the WACOR and the QA staff, research can proceed. The Contractor shall conduct field and laboratory work in a manner consistent with the QAPP(s), and according to NRMRL QA procedures. Both the WACOR and QAM will review any new or modified QAPP(s).

4. Work / Experimental Requirements
The contractor shall:
a) Conduct and provide support for laboratory and environmental (field) sampling and monitoring efforts as specified in associated SOPs, newly developed methods, and/or QAPPs. Task requirements include supporting and collecting ecology and water quality data from laboratories and field sites (using established SOPs) for various biological and chemical analyses. The task will include conducting post-collection processing, following chain of custody requirements, and preserving environmental samples. Sampling will include collection of soils and sediments (stream bed, wetland) from field sites, ecological sampling (sediment and whole stream respiration, periphyton, etc.), hydrologic sampling (measurement of discharge and transect/reach characterization for streams), water quality sampling (grab and/or field-filtered samples for nutrients, metals, ions, organic carbon, alkalinity and suspended sediment) and other types of sampling determined by EPA WACOR on a task by task basis.

b) Conduct sampling/measurement support operations including: cleaning, instrument calibration, maintenance, and upgrades, management of expendable/consumable supplies and chemicals associated with activities, and data management and file archiving. *Purchase consumables supplies as needed to maintain continuity and quality of samples and analyses.*

c) As requested by EPA WACOR through written technical direction, develop new SOPs, HASPs, and QAPPs as needed, and update existing SOPs, HASPs, and QAPPs (according to LRPCD format) to address calibration, programming, deployment, maintenance and data management for various automated and non-automated field sampling devices utilized in the ongoing studies of watershed (biological and chemical) stressors.

5. Progress Meetings

The Contractor shall participate in progress meetings, as requested, with the WACOR and shall provide information concerning the progress of laboratory activities, notify the WACOR of problems, and review results. If appropriate, other EPA staff may attend these meetings at the request of the WACOR. Meetings will be held with the WACOR as often as needed. The Contractor shall also prepare summaries or minutes of these meetings and distribute to the WACOR.

6. Expected Outputs

a) The contractor shall tailor individual project analytical data to each project. In most cases the expected data will take the form of electronic records in a format suitable for further manipulation (Excel or specific instrument software packages (e.g., Beckman-Coulter LS230, YSI 6600 data). QA/QC data will be included with each report.

b) Laboratory notebooks and field equipment logs detailing maintenance, repair and deployment records in accordance with LRPCD laboratory protocols and QA/QC procedures.

c) Analysis and reporting based on project data may be required, but will be determined on a project by project basis. If project reports are requested, they will be provided by the contractor in a format acceptable to the WACOR for the specific project. In general, these reports will follow the accepted EPA numbered report format as used by NRMRL/LRPCD. An example is available at:
http://www.epa.gov/nrmrl/pubs/600r10126/600r10126.pdf

7. Comments

Potential Rooms/Labs: AWBERC B2-B6, 401-403,404-409, 424-430, 432-436, 438-442, 701-704, 708, 715, 720-722, 729 and FCF Room 108.

Laboratory instruments include: Shimadzu TOC/TNM/SSM, SEAL Analytical Colorimetric Analyzer and Beckman-Coulter LS230. New instrumentation for FY16

includes the DGA-MIMS gas analyzer, and others as required on a project by project basis.

Field equipment and instruments include: YSI DO Meters and 6600 Multi-Parameter Water Quality meters/sondes, ISCO automated water samplers, In-Situ level loggers, Rickly stream discharge meters, equipment for measuring stream re-aeration, portable weather stations, and a variety of field portable instruments to determine soil and water parameters, and global position (GPS) and various other field equipment as provided by EPA WACOR through written technical direction.

Quality Assurance

All research activities which generate data must follow the guidance of ORD policy and procedures manual section 13.4, *Minimum QA\QC Practices for ORD Laboratories Conducting Research*: PPM 13.4 Training.

Research records shall follow the applicable policy for laboratory notebooks, according to ORD policy and procedure manual section 13.2, *Paper Laboratory Records*: PPM 13.2 Training.

Copies of the current Quality Assurance policies may obtained here: Chapter 13 Policy and Procedures Manual.

When applicable, the contractor shall follow SOPs published by LRPCD at http://intranet.ord.epa.gov/p2/nrmrl/standard-operating-procedures-technical-lrpcd. As SOPs are revised and new SOPs are published, the list of approved SOPs changes, therefore it is important that SOPs published at this web location be consulted when referencing LRPCD SOPs.

The tasks and subtasks inn this contract action identify QAPPs which will or may require revision. QAPP revisions must be reviewed and approved by the LRPCD QA manager before research begins under this work assignment.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-61

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	09/30/2015 To 09/29/2016 Base X Option Period Number	Environmental Stressor Studies

Contractor: PEGASUS TECHNICAL SERVICES, INC.

Specify Section and paragraph of Contract SOW: section 4-B, E, H

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

Period of Performance: From 10/09/2015 To 09/29/2016

Comments:
The purpose of this amendment is to increase the funded ceiling to the work plan approved amount.

☐ 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: 09/30/2015 To 09/29/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Ronald Herrmann	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7741 FAX Number:
Project Officer Name Michael Moeykens	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7196 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:

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-62

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	09/30/2015 To 09/29/2016 Base X Option Period Number	Great Lakes Molecular

Contractor: PEGASUS TECHNICAL SERVICES, INC.

Specify Section and paragraph of Contract SOW: 4 E

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

Period of Performance: From 07/01/2016 To 09/29/2016

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

	Cost/Fee:	LOE:
Contract Period: 09/30/2015 To 09/29/2016		0
This Action:		0
Total:		0

Work Plan / Cost Estimate Approvals

	Cost/Fee	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name Greg Toth	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-569-7242 FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-569-7196 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 (PWS)
Risk Management and Ecological Exposure
Research Support Contract
Pegasus, EP-C-15-010
WA 0-62

WORK ASSIGNMENT–CONTRACTING OFFICER'S REPRESENTATVE (WA-COR):

Greg Toth
Exposure Methods and Measurement Division
National Exposure Research Laboratory
U.S. Environmental Protection Agency
26 W Martin Luther King Dr.
Cincinnati, OH 45268
Phone: (513) 569-7242 FAX: (513) 569-7464

ALTERNATE WA-COR:

Denise A. Gordon
Exposure Methods and Measurement Division
Ecological Exposure Research Division
National Exposure Research Laboratory
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Cincinnati, OH 45268
Phone: (513) 569-7594 FAX: (513) 569-7464

TITLE:
Support for Next Generation DNA Sequencing – Great Lakes Project

PERIOD OF PERFORMANCE:
Task 1 – CO Issuance – July 1, 2016
Tasks 2 – 10 – July 1, 2016 – September 29, 2016

LEVEL OF EFFORT:
1,395

ON-SITE:
AWBERC

BACKGROUND/OBJECTIVES
The National Exposure Research Laboratory (NERL) has devised a research strategy to develop the means to reveal the critical stressors that threaten the Nation's ecological resources and the natural cycles that support all life. The strategy involves two main parts. In one, scientific tools are developed to measure exposures that place valued ecological resources at risk. Regional priorities serve as the driving force for focusing research on particular indicators or indicator types. In the second, the ability to measure and analyze exposures

to environmental stressors is used to assess the vulnerability of ecosystems. The empirical data resulting from this research is used by the Agency to diagnose ecological problems (retrospective risk assessment) or to forecast future ecological conditions (prospective risk assessment).

GOAL/PURPOSE

Working with the Great Lakes National Program Office, NERL's Systems Exposure Division is conducting research to characterize exposures to a critical Great Lakes stressor, invasive species, using next generation DNA sequencing. As a threat to the integrity of aquatic ecosystems, evaluation of the populations of invasive species can assist in identifying the key ecological and genetic variables that facilitate colonization and dispersal of these species. This research includes the preparation of field aquatic samples followed by their analysis with pyrosequencing instrumentation. DNA sequencing runs will be followed by bioinformatic analysis of data.

TASK DESCRIPTIONS

(1) **Work Plan and Orientation**

The work plan shall be configured to clearly align with the tasks outlined in this PWS as much as possible, including listing applicable SOPs by task. The Contractor shall meet with the WACOR for orientation, tour of the facilities, and SOP delivery. QA requirements for specific procedures are detailed in SOPs as needed.

Tasks performed under this work assignment relate to two EPA/ORD/NERL projects for which QAPPs exist:

- QA-EERD-40
  - Benthic bioassessments using next-generation DNA sequencing technologies
  - PIs - Erik Pilgrim, John Martinson
  - ORD Task SSWR 1.1B
- QA-EERD-50
  - 2013 Regional Methods Initiative (RMI): Benthic macroinvertebrate DNA barcoding project
  - Erik Pilgrim, Jim Lazorchak
  - ORD Task – Region 1 RMI Project

Deliverable: Attend orientation within 15 days of the effective date of the approved work assignment and before the July 1 start date of the rest of the tasks.

(2) **Genomic DNA extractions & colony plating**

As specified by written technical directives from the EPA WACOR (no more than 10) the contractor shall perform genomic DNA extractions or colony plating from biological tissue or lysates according to SOPs.

(1) Deliverables

(1) Genomic DNA template from up to 1,200 extractions by September 29, 2016.

(2) SOPs (including, but not limited to)

(1) M-01-100 DNA Isolation Using the MasterPure Complete DNA and RNA Purification Kit

(2) M-13-525 Qiaquick Purification

(3) M-11-502 Qiagen DNeasy DNA Extraction from Frozen or Dried Fish Tissue

(4) M-11-561 Periodic QA for DNA Extraction and COI Amplification

(3) **DNA template quantification**

As specified by written technical directives from the EPA WACOR (no more than 8) the contractor shall estimate DNA concentration of provided template according to SOPs provided by EPA (e.g., PicoGreen, absorbance assay using plate reader or single-sample instrumentation).

(1) Deliverables

(1) Stock and diluted genomic DNA's for up to 500 extractions by September 29, 2016.

(2) SOPs (including, but not limited to)

(1) MERB M-12-553 BioTek (absorbance) DNA Quantification

(2) M-12-554 Bio Tek-PicoGreen DNA Quantification Assay

(3) M-12-569 DNA, RNA and Protein Quantification Using the Qubit Fluorometer

(4) **PCR amplifications**

As specified by written technical directives from the EPA WACOR (no more than 8), the contractor shall perform PCR amplifications according SOPs.

(1) Deliverables

(1) Amplification of up to 500 samples by September 29, 2016.

(2) SOPs (including, but not limited to)

(1) Protocols provided by Principal Investigator for specific parameters, primers, and reagents for organism(s) in question using on-site government provided molecular instruments for PCR amplification.

(5) **Purification of amplification product**

As specified by written technical directives by the EPA WACOR (no more than 8), he contractor shall purify amplification products according to SOPs. The contractor shall quantify DNA in the purified reactions and an aliquot diluted to a specified concentration according to SOPs.

(1) Deliverables

(1) Purification/quantitation of up to 2500 samples by September 29, 2016

(2) SOPs (including, but not limited to)

(1) M-13-525 Qiaquick Purification

(6) **DNA cycle sequencing & purification**

As specified by written technical directives from the EPA WACOR (no more than 5), the contractor shall perform DNA cycle sequencing & purification of reactions according to SOPs. Each sequencing reaction shall include one negative and one positive control sample.

(1) Deliverables

(1) DNA cycle (Sanger) sequencing and purification of up to 50 96-well plates by September 29, 2016.

(2) SOPs (including, but not limited to)

(1) M-13-525 Qiaquick Purification
(2) M-16-546 Agarose Gel Preparation and Electrophoresis
(3) M-13-557 BigDye Sequencing and XTerminator Cleanup
(4) M-13-558 Genotyping or Sequencing Run Setup on the ABI 3730xl DNA Analyzer
(5) M-16-547 Instructions for using Kodak Gel Logic gel imaging system

(7) **Genome or amplicon library preparation and subsequent pyrosequencing run**

As specified by written technical directives from the EPA WACOR (no more than 10), the contractor shall prepare genomic or amplicon library and perform subsequent pyrosequencing run on the GS-FLX genome sequencer according to SOPs.

(1) Deliverables

(1) Library prep for up to 2 genomes or amplicons by September 28, 2015
(3) Up to 2 GS-FLX sequencing runs, including transfer of raw data to computing cluster, for prepared libraries by September 29, 2016

(2) SOPs

(1) M-13-580 GS FLX Rapid Library Prep
(2) M-13-581 GS FLX emPCR Lib-L SVE
(3) M-13-582 GS FLX emPCR Lib-L MVE
(4) M-13-583 GS FLX emPCR Lib-L LVE
(5) M-13-574 GS FLX emPCR Lib-A 1xAmp LVE
(6) M-13-575 GS FLX emPCR Lib-A MVE
(7) M-13-576 GS FLX emPCR Lib-A SVE
(8) M-13-577 GS FLX Sequencing Run
(9) GS-FLX 454 Genome Sequencer manufacturer's protocols

(8) **Processing/analyzing/handling next generation sequence data**

As specified by written technical directive from the EPA WACOR (no more than 3), the contractor shall provide bioinformatics services consisting of primarily processing/analyzing/handling high throughput sequencing (HTS) data, most of which is likely to come from the on-site Roche 454 Genome Sequencer FLX instrument, an on-site Illumina MiSeq instrument or an offsite HiSeq 2500.

Typically the contractor shall support projects aimed at characterizing biodiversity of environmental samples and the identification of differentially expressed genes from organisms exposed to chemical contaminants. For biodiversity-focused projects, contractor services shall begin with FASTQ or FASTA sequence files and corresponding quality files generated by the instruments, and subsequent data analysis is likely to include filtering raw data followed by sequence based biodiversity assessment using loci such as 16S and 18S ribosomal DNA, and DNA barcode targets (e.g., COI gene). These types of analyses may include taking the sequence data through initial analyses such as clustering into operational taxonomic units (OTU), taxonomic assignment, and construction of phylogenetic trees from representative sequences of OTUs, and also downstream statistical analyses, visualization, and production of publication quality graphics. Examples of tools that may be used to perform such analyses and produce such products are those such as found in "UPARSE" (http://drive5.com/**uparse**/) and "QIIME" (http://qiime.sourceforge.net/), however due to the fast evolving nature of HTS sequence analysis in the realm of metagenetics and metagenomics, other specific software packages are not listed here. There will be property will be available for contractor use.

For transcriptomics studies, the contractor shall provide services that will typically begin with FASTQ files. The contractor shall evaluate sequence information for quality and subsequently process to remove sequencing artifacts. Analyses will include reference genome or de novo alignment, normalization and the identification of differentially expressed genes. Examples of tools that may be used are bowtie, bowtie2, TopHat, DESeq, EdgeR, PoissonSeq, cufflink and BaySeq. The contractor should also have a strong background and familiarity with the R statistical package. The contractor shall process and manipulate data within R.

In addition to handling HTS data, the contractor may process/analyze Sanger-based sequence data, generated on-site or obtained from other sources. The contractor may curate such data and develop and maintain one or more "reference" databases that other Sanger-based or NGS sequence data can be compared to as part of the biodiversity analyses discussed previously or for other reasons. The exact form of such databases and their contents would be specified via written technical direction, however at a minimum would consist of uniquely identified FASTA sequences and associated metadata about the samples from which the sequences were generated, including taxonomic information, in a spreadsheet format.

(9) **Routine Equipment Maintenance & Data Archival**

The contractor shall oversee routine equipment maintenance necessary for normal operations on all instruments included in protocols provided to

perform the tasks listed herein. The contractor will be responsible for performing any weekly/bi-weekly/monthly calibration, washing and/or priming procedures necessary for the proper maintenance of said instruments. The contractor shall be responsible for maintaining user logs, detailing maintenance or corrective procedures performed (including bi-weekly monitoring temperature of lab refrigerators and freezers, weekly eyewash checks, monthly pipettor testing, and maintaining chemical inventory as described in the AWBERC Chemical Hygiene Plan). The contractor shall be responsible for archiving all deliverable data generated to appropriate storage media (CD, DVD, external hard drive) on a monthly basis. The contractor shall be responsible for, where appropriate, scheduling annual preventative maintenance with the vendors of such equipment. EPA shall be notified in advance of any such scheduling to ensure that proper procurement procedures have been followed. The contractor will develop additional equipment protocols, as needed, to increase sample throughput, as well as reduce cost.

(1) Deliverables

1) Delivery of all service/maintenance reports generated within the base period by September 29, 2016

2) Delivery of archived deliverable data, each month, within the base period with each monthly report.

3) Delivery of all new/optimized protocols within the base period by September 29, 2016

(10) **Technical Meetings**

The contractor shall attend technical meetings that will be scheduled by EPA (WA-COR, CO or PO). The contractor shall be responsible for preparing summaries and graphic displays of research data generated from the above tasks for any technical clarification to be addressed at the meeting. The contractor shall be responsible for composing and distributing the minutes of all technical meetings to those in attendance within 5 working days of the meeting.

(1) Deliverables

1) Delivery of minutes from all technical meetings held within the base period by September 29, 2016.

DESCRIPTION OF DELIVERABLES

The deliverables shall include documentation of completed analyses, preparation of data files and technical reports specifying the procedures and systems to be used for statistical analyses of data, technical reports specifying laboratory protocols that were developed, confirmation of protocols used, and safety and work plans for experiments. WA-COR is informed of the location of electronic copies of deliverables via email. Hardcopies deliverables shall be made available upon request of the WA-COR.

ACCEPTANCE PROCEDURE FOR DELIVERABLES

Deliverables shall be delivered to the WA-COR. The WA-COR will advise the contractor of any problems with deliverable within 3 weeks after receipt of the deliverable. The contractor shall submit the revised deliverable within 3 weeks after receipt of WA-COR's comments but before the end of the contract period.

REPORTING REQUIREMENTS

As part of the monthly progress report required by the contract, information for this work assignment shall include all task numbers, and whether each is completed or work-in-progress. This monthly report shall provide the description of work performed within each broad task and shall address problems and/or solutions (including issues relating to quality assurance and quality control), work planned for next reporting period, staffing, budget and any changes in technical direction. This monthly report will also include the location of any analytical data/deliverable not otherwise communicated to the WA-COR via email during the course of the month. Meetings shall be held between the contractor, WA-COR, and EPA researcher to discuss work progress, results, or issues of data quality on an as-needed basis.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-63

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	09/30/2015 To 09/29/2016 Base X Option Period Number	Molecular Internal Exposure In

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	4 - E(4), F(3), and H (all)

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

Period of Performance: From 07/01/2016 To 09/29/2016

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: 09/30/2015 To 09/29/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Denise Gordon	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7594 FAX Number:
Project Officer Name Michael Moeykens	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7196 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
Pegasus, EP-C-15-010
WA 0-63

TITLE: Molecular Internal Exposure Indicators Research Services

WORK ASSIGNMENT–CONTRACTING OFFICER'S REPRESENTATVE (WA-COR):
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PERIOD OF PERFORMANCE:
TASK 1 ONLY: CO WA Issuance – September 29, 2016
TASKS 2 – 12: July 1, 2016 – September 29, 2016

LEVEL OF EFFORT: 1,525

LOCATION: Andrew W. Breidenbach Environmental Research Center (AWBERC), 26 W Martin Luther King Drive, Cincinnati, OH 45268

BACKGROUND/OBJECTIVES

The National Exposure Research Laboratory (NERL) has devised a research strategy to develop the means to reveal the critical stressors that threaten the Nation's ecological resources and the

natural cycles that support all life. The strategy involves two main parts. In one, scientific tools are developed to measure exposures that place valued ecological resources at risk. Regional priorities serve as the driving force for focusing research on particular indicators or indicator types. In the second, the ability to measure and analyze exposures to environmental stressors is used to assess the vulnerability of ecosystems. The empirical data resulting from this research is used by the Agency to diagnose ecological problems (retrospective risk assessment) or to forecast future ecological conditions (prospective risk assessment).

The Internal Exposure Indicators Branch (IEIB) of the Exposure Methods and Measurements Division (EMMD) of NERL has organized its research to address development of biological and biochemical indicators of exposure. These indicators span levels of biologic organization from subcellular indicators (biochemical concentrations) to population level indicators (genetic heterogeneity of populations of a species) of eukaryotic species. Genetic research spans the range from genetic fingerprinting to genetic toxicology. Research focuses not only on the development of innovative, laboratory scale methods, but also the evaluation of these methods in the field to establish reference levels and uncertainties. These latter data will aid in application of the developed indicators in both source- biased and regional vulnerability ecological exposure field studies.

GOAL/PURPOSE

GENE EXPRESSION

The objective of IEIB's research is to develop specific, sensitive molecular methods for the detection of exposures to pesticides, endocrine disrupting compounds (EDCs), polyaromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and metals in aquatic ecosystems by studying the changes in gene expression. Support for this approach comes from the observation of endocrine disrupting activity in PAHs, PCBs, steroids, androgens, and pesticides ranging from banned, but persistent, organochlorine pesticides such as DDT (and its metabolites [DDE]) to the modern, moderately persistent pesticides as the triazines (atrazine). Methods developed in this task involve detection of changes in gene transcriptions and relative levels of tissue-specific messenger RNA (mRNA), which occur as a result of direct contact of fish and/or aquatic invertebrate tissue with xenobiotic chemicals present in the environment, and the measurement of these chemicals by novel molecular methods. The specific research goal of this task is to identify novel genes, which are differentially regulated in response to environmental stressors. Once developed, these molecular methods will be applied to regional exposure characterizations to measure the intensity and distribution of specific chemical stressors. The measurement endpoint will be quantifiable differences in tissue-specific gene expression. The literature reports that many investigators rely on tissue or blood protein analyses for exposure characterization. However, detection of proteins represents indicators at the terminus of the biochemical response pathway. This fact leads to analytical uncertainty resulting from differences in RNA translation efficiency and in relative half-lives for these proteins. In fact, the most recent literature describes errors that arise during protein synthesis with aging, independent of genetic changes. Environmental exposures could be a confounding influence in post-transcriptional processing. Molecular indicators which measure transcriptional changes induced

by stressors offers the greatest reduction in uncertainty for EDC and pesticide exposure characterization.

PATHOGEN AND MICROBIAL COMMUNITY ANALYSES SUPPORT

From the Microbial Exposure Branch (EEMD/NERL) mission statement: "**The Microbial Exposure Branch** (MEB) develops and uses methods to detect pathogens and indicators of microbial presence as well as sophisticated data analysis to address critical research questions. In addition, it will support EPA regulatory development and implementation, particularly in collaboration with the Office of Water. The data and tools produced by MEB will be used to develop better risk estimates of human exposures to microorganisms in both the built (e.g., drinking water, indoor air) and natural environments (e.g., recreational waters). The areas of research expertise needed for this work include sample preparation and processing, molecular detection, viability assessment, microbial persistence, microscopy, bioinformatics, and large scale data manipulation."

BIOINFORMATIC ANALYSIS AND STATISTICAL SUPPORT OF NEXT GENERATION SEQUENCE DATA COLLECTED FROM ENVIRONMENTAL SAMPLES

EMMD and the Systems Exposure Division (SED) require bioinformatics support, which will primarily be processing/analyzing/handling next generation sequence (NGS) data, most of which is likely to come from the on-site Illumina MiSeq instrument. Typically the contractor shall support projects aimed at characterizing microbial communities in environmental water samples, both in terms of taxonomy (i.e. using 16S, 18S or other loci) and functionality (i.e. metagenomics and RNA-seq), describing the genome sequence of waterborne pathogens (whole genome sequencing), and assessing the metatranscriptome of bacterial communities in specific environments, or other NGS data.

TASK DESCRIPTIONS

Task 1 ONLY starts at CO WA issuance.

(1) **Orientation**

After WA issuance and prior to work plan submission, the Contractor shall arrange to tour the facility for familiarization of labs and equipment to be used by contract staff, deliver any necessary Standard Operating Procedures (SOPs) for use at the start of work, and if needed, meet with the WA-COR for clarification of any facility and/or work assignment needs. As the contractor prepares the work plan, consider clearly aligning the work plan with the tasks outlined in this PWS as much as possible, including listing applicable SOPs by task. The QA requirements for specific procedures are detailed in SOPs as needed.

Tasks 2 – 11 – July 1, 2016 – September 29, 2016.

(2) **Genomic DNA extractions & colony plating**

The contractor shall perform genomic DNA extractions or colony plating from biological tissue or lysates according to protocols provided by the EPA WACOR.

(1) Deliverables

(1) Genomic DNA template for up to 2 plates by September 29, 2016.

(2) SOPs (including, but not limited to)

(1) M-01-100 DNA Isolation Using the MasterPure Complete DNA and RNA Purification Kit

(2) M-13-525 Qiaquick Purification

(3) M-11-502 Qiagen DNeasy DNA Extraction from Frozen or Dried Fish Tissue

(4) M-11-561 Periodic QA for DNA Extraction and COI Amplification

(3) **DNA template quantification**

The contractor shall estimate DNA concentration of provided template according to protocols provided by the EPA WACOR (e.g., Pico Green, absorbance assay using plate reader or single-sample instrumentation).

(1) Deliverables

(1) Stock and diluted genomic DNA for up to 2 plates by September 29, 2016.

(2) SOPs (including, but not limited to)

(1) MERB M-12-553 BioTek (absorbance) DNA Quantification

(2) M-12-554 Bio Tek-PicoGreen DNA Quantification Assay

(3) M-12-569 DNA, RNA and Protein Quantification Using the Qubit Fluorometer

(4) **PCR amplifications**

The contractor shall perform PCR amplifications according to protocols provided the by EPA WACOR.

(1) Deliverables

(1) Amplification of up to 2 plates by September 29, 2016.

(2) SOPs (including, but not limited to)

(1) Protocols provided by Principal Investigator for specific parameters, primers, and reagents for organism(s) in question using on-site government provided molecular instruments for PCR amplification.

(5) **Purification of amplification product**

The contractor shall purify amplification products according to protocols provided by the EPA WACOR. The contractor shall quantify DNA in the purified reactions and an aliquot diluted to a specified concentration according to a protocol that will be prepared by the EPA.

(1) Deliverables

(1) Purification/quantitation of up to 2 plates by September 29, 2016.

(2) SOPs (including, but not limited to)

(1) M-13-525 Qiaquick Purification

(6) **DNA cycle sequencing & purification**

The contractor shall perform DNA cycle sequencing & purification of reactions according to protocols that will be provided by the EPA WACOR. Each sequencing reaction shall include one negative and one positive control sample.

(1) Deliverables

(1) DNA cycle (Sanger) sequencing and purification of up to two (2) 96-well plates by September 29, 2016.

(2) SOPs (including, but not limited to)

(1) M-13-525 Qiaquick Purification

(2) M-16-546 Agarose Gel Preparation and Electrophoresis
(3) M-13-557 BigDye Sequencing and XTerminator Cleanup
(4) M-13-558 Genotyping or Sequencing Run Setup on the ABI 3730xl DNA Analyzer
(5) M-16-547 Instructions for using Kodak Gel Logic gel imaging system

(7) **ABI 3730xl automated capillary electrophoresis**

The contractor shall perform capillary electrophoresis of genotyping or sequencing products on the ABI 3730xl automated DNA analyzer according to protocols -provided by the EPA WACOR.

(1) Deliverables
(1) Up to 1 automated capillary electrophoresis run by September 29, 2016.
(2) SOPs (including, but not limited to)
(1) M-13-558 Genotyping or Sequencing Run Setup on the ABI 3730xl DNA Analyzer

(8) **Pathogen and microbial community drinking water analyses via various methods in support of NERL/EMMD/MEB projects**

The contractor shall conduct various laboratory experiments to evaluate and optimize assays and process samples provided by the EPA Principal Investigator in coordination with the WACOR using culture and molecular methods (PCR, qPCR, clone-sequencing and deep sequencing for 16S rRNA and mRNA) for legionellae, amoebal hosts, Campylobacter spp., harmful algal bloom, etc., collect raw data and make preliminary summary, interpretation and conclusion. The listed experiments are as follows, but not limited to:

1. Detection of *Legionella* spp. and other opportunistic pathogens using direct culturing with and without amoebal hosts (including: *Acanthamoeba polyphaga, Hartmannella vermiformis* and *Naegleria fowleri*) at various temperatures and levels of secondary disinfectants (approximately 150 samples).
2. DNA/RNA from various water samples including field and lab experiments, detect harmful algal species using molecular methods (approximately 600 samples).
3. DNA/RNA from field and experimental samples of animals or tissue cultures for campylobacter detection (approximately 200 samples).

MEB will provide all sequencing, MiSeq NGS, and ppPCR kits, qPCR reagents, and culture supplies for all experiments performed under this task.

(1) Deliverables
Preparation of up to 950 samples as directed by various protocols by September 29, 2016.
(2) Reports summarizing each separate project within 1 week or less after completion of each experiment. Final completion date: September 29, 2016.
(3) SOPs (including, but not limited to)
(1) M-13-525 Qiaquick Purification
(2) M-16-546 Agarose Gel Preparation and Electrophoresis
(3) M-13-557 BigDye Sequencing and XTerminator Cleanup
(4) M-13-558 Genotyping or Sequencing Run Setup on the ABI 3730xl DNA Analyzer

(5) MERB M-12-553 BioTek (absorbance) DNA Quantification
(6) M-12-554 Bio Tek-PicoGreen DNA Quantification Assay
(7) M-12-569 DNA, RNA and Protein Quantification Using the Qubit Fluorometer
(8) M-16-547 Instructions for using Kodak Gel Logic gel imaging system
(9) Protocols/user manuals of provided kits

(9) **Bioinformatic analysis of next generation sequence data and statistical support of data collected from environmental samples**

The contractor shall provide bioinformatics services which, will primarily consist of processing/analyzing/handling next generation sequence (NGS) data, most of which is likely to come from the on-site Illumina MiSeq instrument. Typically the services will include characterizing microbial communities in environmental water samples, both in terms of taxonomy (i.e. using 16S, 18S or other loci) and functionality (i.e. metagenomics and RNA-seq), describing the genome sequence of waterborne pathogens (whole genome sequencing), and assessing the metatranscriptome of bacterial communities in specific environments.

The contractor shall be provided NGS data by the EPA Principal Investigator in coordination with the EPA WACOR, format it accordingly, and process the data to assess sequence read quality, trim reads, build contigs, identify contigs, and any other necessary analysis. This will require on-site government provided computer hardware as well as software tools like R Statistics, Mothur, QIIME, USEARCH, Bowtie, BWA, Genome Analysis Toolkit (GATK), RDP Classifier, BLAST and MEGAN, to which the contractor will have access. Analyses of the unclassifiable sequences, such as those expected from virome studies, shall require other analyses, like tetranucleotide frequency comparisons through the use of MetaVir or similar programs. In addition, statistical comparisons of sequence reads collected and analyzed across samples in a study shall need to be performed. In some cases, sequence reads shall be assessed for correlations or patterns with other types of data collected within a study. For example, the taxonomic profile generated from the sequence analysis of a portion of the 16S rRNA bacterial gene in river samples shall be compared using multivariate statistics to other water quality parameters collected as part of the study. Additionally, other analyses and programs may be needed, through receipt of written technical direction from the EPA WACOR.

Statistical support shall be required to analyze data sets describing the occurrence and quantitative risk assessment of microbes in environmental water samples. EMMD and SED scientists routinely collect environmental water samples, including, but not limited to, groundwater, tap, source, recycled and wastewater to monitor for the presence of microbes, including pathogens. However, many targeted microbes, especially the pathogens, are present sporadically and in low concentration. Statistical analysis of these data sets shall be implemented using one or more parametric and/or nonparametric data analysis techniques, the details of which will be determined by the specific requirements of individual data sets. In all cases, methods of statistical analysis shall be adapted specifically for the particulars of the individual data set in a manner that appropriately handles its distributional characteristics, to include the possibility of left-censored data or non-detects, if applicable. Statistical tests include, but are not limited to, basic statistical

metrics, like ANOVA, logistic regression techniques, etc. and advanced statistical models such as poisson- based statistics and Bayesian techniques. The statistical packages, such as SAS, R, S-Plus, MathCad, MATLAB, OpenBUGS may be needed and will be provided by EPA.

(1) Deliverables
   (1) Up to 3 data sets completed by September 29, 2016.
   (2) Prior to the start of services associate with task 9, the contractor shall meet with the EPA WA-COR and the Principal Investigator in order to discuss methods and deliverables. Deadlines of deliverables will be prioritized and mutually agreed upon so as to not incur increased labors hours and costs. Technical discussion, including, but not limited to, data analysis objectives, data interpretation outputs/deliverables and deadlines, can be done between the contractor and PI whose work is being supported. Such discussion does not constitute technical direction. Technical direction will be given to the contractor only via the EPA WA-COR.
   (3) Deliverables shall include, but is not limited to, safety and work plans for analyses, documentation of completed analyses, and figures for use in manuscripts, descriptions of bioinformatic/statistical methods used, technical reports and manuscripts. The specifics of the deliverables of each task shall be discussed prior to the start of each task, as specified above.
   (4) Final completion date: September 29, 2016.

(10) **Routine Equipment Maintenance & Data Archival**

The contractor shall oversee routine equipment maintenance on all instruments according to the instrument's manufacturer's recommendations. The contractor shall be responsible for performing any weekly/bi-weekly/monthly calibration, washing and/or priming procedures necessary for the proper maintenance of said instruments. The contractor shall be responsible for maintaining their lab space, user logs, detailing maintenance or corrective procedures performed (including bi-weekly monitoring temperature of lab refrigerators and freezers, weekly eyewash checks, monthly pipettor testing, and maintaining chemical inventory as described in the AWBERC Chemical Hygiene Plan). The contractor shall be responsible for archiving all deliverable data generated to appropriate storage media (CD, DVD, external hard drive) on a monthly basis. The contractor shall be responsible for, where appropriate, scheduling annual preventative maintenance with the vendors of such equipment. EPA shall be notified in advance of any such scheduling to ensure that proper procurement procedures have been followed. The contractor shall develop additional equipment protocols, as needed, to increase sample throughput, as well as reduce cost.

(1) Deliverables
   (1) Delivery of all service/maintenance reports generated within the WA period of performance by September 29, 2016.
   (2) Delivery of archived deliverable data, each month, within the WA period of performance with each monthly report.
   (3) Delivery of all new/optimized protocols within the WA period of performance by September 29, 2016.

(11) **Technical Meetings**

The contractor shall attend technical meetings that will be scheduled by the EPA WA-COR. It is anticipated that there will be no more than 3 technical meetings during the WA period of performance. The contractor shall be responsible for preparing summaries and graphic displays of research data generated from the above tasks for any technical clarification to be addressed at the meeting. The contractor shall be responsible for composing and distributing the minutes of all technical meetings to those in attendance within 5 working days of the meeting.

(1) Deliverables

(1) Delivery of minutes of each meeting within 5 working days of the meeting.

DESCRIPTION OF DELIVERABLES

The deliverables shall include documentation of completed analyses, preparation of data files and technical reports specifying the procedures and systems to be used for statistical analyses of data, technical reports specifying laboratory protocols that were developed, confirmation of protocols used, and safety and work plans for experiments. The WA-COR shall be informed of the location of electronic copies of deliverables via email. Hardcopies deliverables shall be made available upon request of the WA-COR.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-63

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	09/30/2015 To 09/29/2017 Base X Option Period Number	Molecular Internal Exposure In

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	Section 4, F(3) and H (all)

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

Period of Performance: From 07/01/2016 To 09/29/2016

Comments:
This amendment is to add a new task to the PWS.

☐ 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: 09/30/2015 To 09/29/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Denise Gordon	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7594 FAX Number:
Project Officer Name Michael Moeykens	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7196 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
Pegasus, EP-C-15-010
WA 0-63
Amendment #1- revised information in **bold red** type with any previous wording overstruck.
This amendment is adding Task #12.

TITLE: Molecular Internal Exposure Indicators Research Services

WORK ASSIGNMENT–CONTRACTING OFFICER'S REPRESENTATVE (WA-COR):
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United States Environmental Protection Agency
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Internal Exposure Indicators Branch
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FAX: (513) 569-7464
Email: toth.greg@epa.gov

PERIOD OF PERFORMANCE:
TASK 1 ONLY: CO WA Issuance – September 29, 2016
TASKS 2 – 12: July 1, 2016 – September 29, 2016

LEVEL OF EFFORT: ~~1,525~~ **1815**

LOCATION: Andrew W. Breidenbach Environmental Research Center (AWBERC), 26 W Martin Luther King Drive, Cincinnati, OH 45268

BACKGROUND/OBJECTIVES

The National Exposure Research Laboratory (NERL) has devised a research strategy to develop the means to reveal the critical stressors that threaten the Nation's ecological resources and the natural cycles that support all life. The strategy involves two main parts. In one, scientific tools are developed to measure exposures that place valued ecological resources at risk. Regional priorities serve as the driving force for focusing research on particular indicators or indicator types. In the second, the ability to measure and analyze exposures to environmental stressors is used to assess the vulnerability of ecosystems. The empirical data resulting from this research is used by the Agency to diagnose ecological problems (retrospective risk assessment) or to forecast future ecological conditions (prospective risk assessment).

The Internal Exposure Indicators Branch (IEIB) of the Exposure Methods and Measurements Division (EMMD) of NERL has organized its research to address development of biological and biochemical indicators of exposure. These indicators span levels of biologic organization from subcellular indicators (biochemical concentrations) to population level indicators (genetic heterogeneity of populations of a species) of eukaryotic species. Genetic research spans the range from genetic fingerprinting to genetic toxicology. Research focuses not only on the development of innovative, laboratory scale methods, but also the evaluation of these methods in the field to establish reference levels and uncertainties. These latter data will aid in application of the developed indicators in both source- biased and regional vulnerability ecological exposure field studies.

GOAL/PURPOSE

GENE EXPRESSION

The objective of IEIB's research is to develop specific, sensitive molecular methods for the detection of exposures to pesticides, endocrine disrupting compounds (EDCs), polyaromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and metals in aquatic ecosystems by studying the changes in gene expression. Support for this approach comes from the observation of endocrine disrupting activity in PAHs, PCBs, steroids, androgens, and pesticides ranging from banned, but persistent, organochlorine pesticides such as DDT (and its metabolites [DDE]) to the modern, moderately persistent pesticides as the triazines (atrazine). Methods developed in this task involve detection of changes in gene transcriptions and relative levels of tissue-specific messenger RNA (mRNA), which occur as a result of direct contact of fish and/or aquatic invertebrate tissue with xenobiotic chemicals present in the environment, and the measurement of these chemicals by novel molecular methods. The specific research goal of this task is to identify novel genes, which are differentially regulated in response to environmental stressors. Once developed, these molecular methods will be applied to regional exposure characterizations to measure the intensity and distribution of specific chemical stressors. The measurement endpoint will be quantifiable differences in tissue-specific gene expression. The literature reports that many investigators rely on tissue or blood protein analyses for exposure characterization. However, detection of proteins represents indicators at the terminus of the biochemical response pathway. This fact leads to analytical uncertainty resulting from differences in RNA translation efficiency and in relative half-lives for these proteins. In fact, the

most recent literature describes errors that arise during protein synthesis with aging, independent of genetic changes. Environmental exposures could be a confounding influence in post-transcriptional processing. Molecular indicators which measure transcriptional changes induced by stressors offers the greatest reduction in uncertainty for EDC and pesticide exposure characterization.

PATHOGEN AND MICROBIAL COMMUNITY ANALYSES SUPPORT

From the Microbial Exposure Branch (EEMD/NERL) mission statement: "**The Microbial Exposure Branch** (MEB) develops and uses methods to detect pathogens and indicators of microbial presence as well as sophisticated data analysis to address critical research questions. In addition, it will support EPA regulatory development and implementation, particularly in collaboration with the Office of Water. The data and tools produced by MEB will be used to develop better risk estimates of human exposures to microorganisms in both the built (e.g., drinking water, indoor air) and natural environments (e.g., recreational waters). The areas of research expertise needed for this work include sample preparation and processing, molecular detection, viability assessment, microbial persistence, microscopy, bioinformatics, and large scale data manipulation."

BIOINFORMATIC ANALYSIS AND STATISTICAL SUPPORT OF NEXT GENERATION SEQUENCE DATA COLLECTED FROM ENVIRONMENTAL SAMPLES

EMMD and the Systems Exposure Division (SED) require bioinformatics support, which will primarily be processing/analyzing/handling next generation sequence (NGS) data, most of which is likely to come from the on-site Illumina MiSeq instrument. Typically the contractor shall support projects aimed at characterizing microbial communities in environmental water samples, both in terms of taxonomy (i.e. using 16S, 18S or other loci) and functionality (i.e. metagenomics and RNA-seq), describing the genome sequence of waterborne pathogens (whole genome sequencing), and assessing the metatranscriptome of bacterial communities in specific environments, or other NGS data.

GREAT LAKES INVASIVE SPECIES PROJECT SUPPORT

SED requires molecular support for larval fish collected from Lakes Superior, Michigan, and Huron and analyzed through DNA metabarcoding, via Roche GS-FLX 454 sequencing protocols, for the detection and monitor of invasive species of fish.

TASK DESCRIPTIONS

Task 1 ONLY starts at CO WA issuance.

(1) **Orientation**

After WA issuance and prior to work plan submission, the Contractor shall arrange to tour the facility for familiarization of labs and equipment to be used by contract staff, deliver any necessary Standard Operating Procedures (SOPs) for use at the start of work, and if needed, meet with the WA-COR for clarification of any facility and/or work assignment needs. As the contractor prepares the work plan, consider clearly aligning the work plan with the tasks outlined

in this PWS as much as possible, including listing applicable SOPs by task. The QA requirements for specific procedures are detailed in SOPs as needed.

Tasks 2 – ~~11~~ **12** – July 1, 2016 – September 29, 2016.

(2) **Genomic DNA extractions & colony plating**
The contractor shall perform genomic DNA extractions or colony plating from biological tissue or lysates according to protocols provided by the EPA WACOR.
(1) Deliverables
(1) Genomic DNA template for up to 2 plates by September 29, 2016.
(2) SOPs (including, but not limited to)
(1) M-01-100 DNA Isolation Using the MasterPure Complete DNA and RNA Purification Kit
(2) M-13-525 Qiaquick Purification
(3) M-11-502 Qiagen DNeasy DNA Extraction from Frozen or Dried Fish Tissue
(4) M-11-561 Periodic QA for DNA Extraction and COI Amplification

(3) **DNA template quantification**
The contractor shall estimate DNA concentration of provided template according to protocols provided by the EPA WACOR (e.g., Pico Green, absorbance assay using plate reader or single-sample instrumentation).
(1) Deliverables
(1) Stock and diluted genomic DNA for up to 2 plates by September 29, 2016.
(2) SOPs (including, but not limited to)
(1) MERB M-12-553 BioTek (absorbance) DNA Quantification
(2) M-12-554 Bio Tek-PicoGreen DNA Quantification Assay
(3) M-12-569 DNA, RNA and Protein Quantification Using the Qubit Fluorometer

(4) **PCR amplifications**
The contractor shall perform PCR amplifications according to protocols provided the by EPA WACOR.
(1) Deliverables
(1) Amplification of up to 2 plates by September 29, 2016.
(2) SOPs (including, but not limited to)
(1) Protocols provided by Principal Investigator for specific parameters, primers, and reagents for organism(s) in question using on-site government provided molecular instruments for PCR amplification.

(5) **Purification of amplification product**
The contractor shall purify amplification products according to protocols provided by the EPA WACOR. The contractor shall quantify DNA in the purified reactions and an aliquot diluted to a specified concentration according to a protocol that will be prepared by the EPA.
(1) Deliverables
(1) Purification/quantitation of up to 2 plates by September 29, 2016.
(2) SOPs (including, but not limited to)

(1) M-13-525 Qiaquick Purification

(6) **DNA cycle sequencing & purification**

The contractor shall perform DNA cycle sequencing & purification of reactions according to protocols that will be provided by the EPA WACOR. Each sequencing reaction shall include one negative and one positive control sample.

(1) Deliverables

(1) DNA cycle (Sanger) sequencing and purification of up to two (2) 96-well plates by September 29, 2016.

(2) SOPs (including, but not limited to)

(1) M-13-525 Qiaquick Purification
(2) M-16-546 Agarose Gel Preparation and Electrophoresis
(3) M-13-557 BigDye Sequencing and XTerminator Cleanup
(4) M-13-558 Genotyping or Sequencing Run Setup on the ABI 3730xl DNA Analyzer
(5) M-16-547 Instructions for using Kodak Gel Logic gel imaging system

(7) **ABI 3730xl automated capillary electrophoresis**

The contractor shall perform capillary electrophoresis of genotyping or sequencing products on the ABI 3730xl automated DNA analyzer according to protocols -provided by the EPA WACOR.

(1) Deliverables

(1) Up to 1 automated capillary electrophoresis run by September 29, 2016.

(2) SOPs (including, but not limited to)

(1) M-13-558 Genotyping or Sequencing Run Setup on the ABI 3730xl DNA Analyzer

(8) **Pathogen and microbial community drinking water analyses via various methods in support of NERL/EMMD/MEB projects**

The contractor shall conduct various laboratory experiments to evaluate and optimize assays and process samples provided by the EPA Principal Investigator in coordination with the WACOR using culture and molecular methods (PCR, qPCR, clone-sequencing and deep sequencing for 16S rRNA and mRNA) for legionellae, amoebal hosts, Campylobacter spp., harmful algal bloom, etc., collect raw data and make preliminary summary, interpretation and conclusion. The listed experiments are as follows, but not limited to:

1. Detection of *Legionella* spp. and other opportunistic pathogens using direct culturing with and without amoebal hosts (including: *Acanthamoeba polyphaga, Hartmannella vermiformis* and *Naegleria fowleri*) at various temperatures and levels of secondary disinfectants (approximately 150 samples).
2. DNA/RNA from various water samples including field and lab experiments, detect harmful algal species using molecular methods (approximately 600 samples).
3. DNA/RNA from field and experimental samples of animals or tissue cultures for campylobacter detection (approximately 200 samples).

MEB will provide all sequencing, MiSeq NGS, and ppPCR kits, qPCR reagents, and culture supplies for all experiments performed under this task.

(1) Deliverables

Preparation of up to 950 samples as directed by various protocols by September 29, 2016.

(2) Reports summarizing each separate project within 1 week or less after completion of each experiment. Final completion date: September 29, 2016.

(3) SOPs (including, but not limited to)

(1) M-13-525 Qiaquick Purification
(2) M-16-546 Agarose Gel Preparation and Electrophoresis
(3) M-13-557 BigDye Sequencing and XTerminator Cleanup
(4) M-13-558 Genotyping or Sequencing Run Setup on the ABI 3730xl DNA Analyzer
(5) MERB M-12-553 BioTek (absorbance) DNA Quantification
(6) M-12-554 Bio Tek-PicoGreen DNA Quantification Assay
(7) M-12-569 DNA, RNA and Protein Quantification Using the Qubit Fluorometer
(8) M-16-547 Instructions for using Kodak Gel Logic gel imaging system
(9) Protocols/user manuals of provided kits

(9) **Bioinformatic analysis of next generation sequence data and statistical support of data collected from environmental samples**

The contractor shall provide bioinformatics services which, will primarily consist of processing/analyzing/handling next generation sequence (NGS) data, most of which is likely to come from the on-site Illumina MiSeq instrument. Typically the services will include characterizing microbial communities in environmental water samples, both in terms of taxonomy (i.e. using 16S, 18S or other loci) and functionality (i.e. metagenomics and RNA-seq), describing the genome sequence of waterborne pathogens (whole genome sequencing), and assessing the metatranscriptome of bacterial communities in specific environments.

The contractor shall be provided NGS data by the EPA Principal Investigator in coordination with the EPA WACOR, format it accordingly, and process the data to assess sequence read quality, trim reads, build contigs, identify contigs, and any other necessary analysis. This will require on-site government provided computer hardware as well as software tools like R Statistics, Mothur, QIIME, USEARCH, Bowtie, BWA, Genome Analysis Toolkit (GATK), RDP Classifier, BLAST and MEGAN, to which the contractor will have access. Analyses of the unclassifiable sequences, such as those expected from virome studies, shall require other analyses, like tetranucleotide frequency comparisons through the use of MetaVir or similar programs. In addition, statistical comparisons of sequence reads collected and analyzed across samples in a study shall need to be performed. In some cases, sequence reads shall be assessed for correlations or patterns with other types of data collected within a study. For example, the taxonomic profile generated from the sequence analysis of a portion of the 16S rRNA bacterial gene in river samples shall be compared using multivariate statistics to other water quality parameters collected as part of the study. Additionally, other analyses and programs may be needed, through receipt of written technical direction from the EPA WACOR.

Statistical support shall be required to analyze data sets describing the occurrence and quantitative risk assessment of microbes in environmental water samples. EMMD and SED scientists routinely collect environmental water samples, including, but not limited to, groundwater, tap, source, recycled and wastewater to monitor for the presence of microbes, including pathogens. However, many targeted microbes, especially the pathogens, are present sporadically and in low concentration. Statistical analysis of these data sets shall be implemented using one or more parametric and/or nonparametric data analysis techniques, the details of which will be determined by the specific requirements of individual data sets. In all cases, methods of statistical analysis shall be adapted specifically for the particulars of the individual data set in a manner that appropriately handles its distributional characteristics, to include the possibility of left-censored data or non-detects, if applicable. Statistical tests include, but are not limited to, basic statistical metrics, like ANOVA, logistic regression techniques, etc. and advanced statistical models such as poisson- based statistics and Bayesian techniques. The statistical packages, such as SAS, R, S-Plus, MathCad, MATLAB, OpenBUGS may be needed and will be provided by EPA.

(1) Deliverables
   (1) Up to 3 data sets completed by September 29, 2016.
   (2) Prior to the start of services associate with task 9, the contractor shall meet with the EPA WA-COR and the Principal Investigator in order to discuss methods and deliverables. Deadlines of deliverables will be prioritized and mutually agreed upon so as to not incur increased labors hours and costs. Technical discussion, including, but not limited to, data analysis objectives, data interpretation outputs/deliverables and deadlines, can be done between the contractor and PI whose work is being supported. Such discussion does not constitute technical direction. Technical direction will be given to the contractor only via the EPA WA-COR.
   (3) Deliverables shall include, but is not limited to, safety and work plans for analyses, documentation of completed analyses, and figures for use in manuscripts, descriptions of bioinformatic/statistical methods used, technical reports and manuscripts. The specifics of the deliverables of each task shall be discussed prior to the start of each task, as specified above.
   (4) Final completion date: September 29, 2016.

(10) **Routine Equipment Maintenance & Data Archival**

The contractor shall oversee routine equipment maintenance on all instruments according to the instrument's manufacturer's recommendations. The contractor shall be responsible for performing any weekly/bi-weekly/monthly calibration, washing and/or priming procedures necessary for the proper maintenance of said instruments. The contractor shall be responsible for maintaining their lab space, user logs, detailing maintenance or corrective procedures performed (including bi-weekly monitoring temperature of lab refrigerators and freezers, weekly eyewash checks, monthly pipettor testing, and maintaining chemical inventory as described in the AWBERC Chemical Hygiene Plan). The contractor shall be responsible for archiving all deliverable data generated to appropriate storage media (CD, DVD, external hard drive) on a monthly basis. The

contractor shall be responsible for, where appropriate, scheduling annual preventative maintenance with the vendors of such equipment. EPA shall be notified in advance of any such scheduling to ensure that proper procurement procedures have been followed. The contractor shall develop additional equipment protocols, as needed, to increase sample throughput, as well as reduce cost.

(1) Deliverables

(1) Delivery of all service/maintenance reports generated within the WA period of performance by September 29, 2016.

(2) Delivery of archived deliverable data, each month, within the WA period of performance with each monthly report.

(3) Delivery of all new/optimized protocols within the WA period of performance by September 29, 2016.

(11) **Technical Meetings**

The contractor shall attend technical meetings that will be scheduled by the EPA WA-COR. It is anticipated that there will be no more than 3 technical meetings during the WA period of performance. The contractor shall be responsible for preparing summaries and graphic displays of research data generated from the above tasks for any technical clarification to be addressed at the meeting. The contractor shall be responsible for composing and distributing the minutes of all technical meetings to those in attendance within 5 working days of the meeting.

(1) Deliverables

(1) Delivery of minutes of each meeting within 5 working days of the meeting.

(12) Great Lakes Sample Roche GS-FLX 454 Sequencing

The contractor shall perform Roche GS-FLX 454 genome sequencing and analysis of larval fish samples according to protocols provided by the EPA WACOR.

(1) Deliverables

(1) Roche GS-FLX 454 genome sequencing of up to seven (7) 96-well plates by September 29, 2016.

(2) SOPs (including, but not limited to)

(1) GS-FLX 454 Genome Sequencer manufacturer's protocols

DESCRIPTION OF DELIVERABLES

The deliverables shall include documentation of completed analyses, preparation of data files and technical reports specifying the procedures and systems to be used for statistical analyses of data, technical reports specifying laboratory protocols that were developed, confirmation of protocols used, and safety and work plans for experiments. The WA-COR shall be informed of the location of electronic copies of deliverables via email. Hardcopies deliverables shall be made available upon request of the WA-COR.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-64

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	09/30/2015 To 09/29/2016 Base X Option Period Number	Technical support for AWBERC

Contractor: PEGASUS TECHNICAL SERVICES, INC.

Specify Section and paragraph of Contract SOW: B4

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

Period of Performance: From 06/06/2016 To 09/29/2016

Comments:

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

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

SFO (Max 2) ☐

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

Authorized Work Assignment Ceiling

Contract Period: 09/30/2015 To 09/29/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Jim Lazorchak	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7076 FAX Number:
Project Officer Name Michael Moeykens	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7196 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

Title: Technical Support for AWBERC Aquatic Research Facilities, Field Activities and Identification of Laboratory and Field Collections of Bacteria, Plants and Animals

Period of Performance:
Task 1 Starts June 20, 2016
Tasks 2-7 - July 1 - September 29, 2016

Contract Number: EP-C-15-010

Work Assignment Number: 0-64

Work Assignment Contracting Officer's Representative (WACOR): Jim Lazorchak

Alternate WACOR: Denise Gordon

Research Location: U.S. EPA, 26 W. Martin Luther King Dr., Cincinnati, Ohio 45268

Background:

The purpose of this work assignment is to provide laboratory and/or field support for culturing algae, invertebrates and vertebrate organisms, conducting exposures, toxicity tests, methods development, data analyses, and the collection and processing of fish, invertebrate, algal and bacteria samples, including sample processing, taxonomic identification, enumeration, and measurement of samples, analyses of algal chlorophyll content, Alkaline and Acid Phosphatase Activity (APA), algal ash free dry mass (AFDM), stable isotope composition, data entry, and data analysis. These activities will support US EPA divisions SED, NERL, NRMRL, NCEA and ORD, Regional and Program Office Collaborators (for example Office of Water or Office of Chemical Safety and Pollution Prevention, Office of Land and Emergency Management) and Partners (EPA Regional Offices, States and Academic institutions) as it pertains to EPA Research Action Plans, Projects and Tasks Ecosystems Services related to contaminated sediments, National Resource Assessments like the National Rivers and Streams Assessment (NRSA), Great Lakes Legacy and Restoration Programs Areas of Concern (AOCs), Nutrient and Harmful algal bloom methods and monitoring research, pesticides, EDCs (endocrine disrupting compounds), pharmaceuticals, Nano materials, major ions and other emerging contaminants, EPA's Experimental Streams Facility (ESF) studies including the East Forks LMR/Harsha Lake Cooperative, eco-restoration, real-time and near real-time biomonitoring research, Regional Methods Initiatives (RMIs), Regional Assisted Research Efforts (RARE) and other ORD initiatives. The Contractor shall provide support to these programs by conducting lab and field exposure assessments and collections, toxicity testing of water and sediment, identification of field organism collections, collection and processing of tissues from test animals for stable isotope analysis, molecular analyses as needed and providing reports on the results of such activities. One important activity is to insure all laboratory and field activities are in conformance with AWBERC Animal and Aquatic facility Institutional Animal Care and Use Committee (IACUC) and Association for Assessment and Accreditation of Laboratory Animal Care (AAALAC) requirements. Organisms to be cultured, reared and held are vertebrates such as, but not limited to, fathead minnows (*Pimephales promelas)*, bluntnose minnows (*Pimephales notatus)*, and zebrafish (*Danio rerio*) for use in aquatic toxicity exposure testing; invertebrates including, but not limited to, *Ceriodaphnia dubia, Daphnia magna, Hyalella azteca, Chironomus tentans, Neocloeon triangulifer,*

Mytilus sp., Corbicula, a western EPT species and other invertebrate and mussel species. Some plant (e.g., algae, diatoms, and duckweed) species are also cultured and used for food and/or testing.

Task Descriptions

Task 1: Facilities and Operations Facilitation
The WACOR will provide operational overview, access to existing SOPs and other information to the contractor in order to ensure that operations of culture and the aquatic facility water system and equipment are completed adequately. Culture and holding of organisms and occasionally some tests will have to be taken care of 7 days/week. The work plan completion will be contingent on attending the orientation with the WACOR.

Task 2: Culture and successfully hold freshwater and/or marine fish, invertebrates, amphibians, and plants to support ORD, EPA Regional and collaborating organizations exposure and testing programs.

A) The contractor shall:

- Trouble shoot and correct Aquatic Facility operational and Logistical issues.
- Provide periodic support for culture and care of freshwater and marine aquatic organisms and plants. Provide SOPs and methods to achieve the following culture and care conditions at AWBERC & ESF.
- Successfully culture fathead minnows such that 2,000 1-day old larvae are available per day. Rear and hold 500 adult fathead minnows for adult exposures for any given test day.
- Successfully culture Zebra fish such that 200 embryos/spawn from one or more pairs of fish are available twice per week.
- Successfully culture *Ceriodaphnia* such that 250 1-day old daphnids are available per day, with a 7-day, 3-brood mean of young per starting number of 20 females, and a Coefficient of Variation (CV) of 20% or less for three broods in 7 days.
- Successfully culture *Daphnia magna.* such that 250 1-day old daphnids are available per day, with a 7-day, 2-brood mean of young per starting number of 20 females, and a Coefficient of Variation (CV) of 20% or less for two broods in 7 days.
- Successfully culture *Hyallela azteca* for sediment toxicity tests, such that 1,000 5 to7-day-old amphipods are available on any given test day and the average weight of 0.03 ug dry weight for 7-8 day olds and >/= 0.3 – 0.4 mg dry weight for 30-day old midges.
- Successfully culture *Chironomus tentans* or other chironmids for sediment toxicity tests, such that 500 chironmids of appropriate test age are available on any given test day.
- Successfully culture the parthenogenic mayfly *Neocloeon triangulfer* for testing, ESF deployments and field exposures. Performance criteria – 1000 eggs per female.
- Successfully hold (> 80% Survival for holding period) up to 200 Corbicula and other mussels provided by the WACOR for use by PIs as specified by written technical direction from the

WACOR.

- Successfully hold other invertebrates provided by the WACOR for use by PIs as specified by written technical direction from the WACOR.

- Organisms under culture or holding will have to be feed and cared for 7-days/week

Deliverables: Contractor shall describe and specify in the contract required monthly progress reports that the above criteria for culturing are met

B) The contractor shall ship excess organisms after receipt of written technical direction from the EPA WACOR. This task is dependent on the availability of excess organisms. The WACOR may receive requests for organisms from EPA Regions, States, Universities, etc. All in-house tasks requiring test organisms will have first priority. The WACOR will submit these requests to the Contractor for determination of available organisms. If organisms are available, the requestor shall be notified by the Contractor that request has been confirmed. The Contractor shall ship organisms at the requestor's cost unless otherwise notified. Number of shipments per month will vary, but may range from 5 to10 and upwards to 100 to 5000 organisms per shipment.

Deliverables: The Contractor shall track shipments by organism in a log and denote such in the monthly progress reports.

Task 3: Indicator Development, Exposure Assessments and Field Collections/Deployments.

A) The contractor shall conduct lab and field exposures of plants, fish (adults and larval), and invertebrates to reference materials (metals, TDS/salt, algal toxins, organics, endocrine disrupting compounds, nano materials etc.), tissue extracts, water and/or sediment samples for the purpose of determining which compounds or environmental samples induce gene expression diagnostic indicators of exposure or affect blood or hemolymph ion concentrations. These exposures may be performed in the laboratory or field.

Approximately 50 - 125 tests are anticipated. Written technical direction from the WACOR will be provided on the design for each of the exposures.

The contractor shall process adult and larval fish tissues for RNA isolation and molecular analyses according to WACOR provided NERL protocols (provided under task 1). Fish and invertebrate tissues along with water shall be processed for stable isotope analysis following protocols (provided under task 1) identified by the WACOR via written technical direction.

B) Upon receipt of written technical direction from the WACOR, the contractor shall operate Flow through Dilutor System for Pesticide, EDCs, Pharmaceuticals, and other chemical and Non Chemical Stressors. Chemical or conditions of operation will be provided by WACOR. The contractor shall provide a summary of performance of each flow through experiment conducted and point out any issues associated with operation of the diluter systems within 2 weeks of completion of each experiment. Up to 3 experiments are anticipated during the work assignment period of performance.

C) The contractor shall operate Static, Aeriated System for exposure of animals to salts enriched in stable

isotopes. The contractor shall conduct 4, 7, 14, and up to 35 day exposures using salts and/or other chemical and Non Chemical stressors identified by the WACOR via written technical direction. The contractor shall provide a final report of each exposure shall be prepared within 2 weeks of completion of each experiment.

D) The contractor shall develop further laboratory and field exposure methods for the parthenogenic mayfly Neoloeon *(Centroptilum) triangulifer* as well as a new culture and testing method for a Western mayfly or caddisfly (as determined via written technical direction from the WACOR). The contractor shall conduct comparability studies to evaluate response differences in western mayfly or caddisfly species against other standard test organism. The contractor shall test different ecoregional water recipes using various ions and new western test species and N triangulifer. Test sensitivity of N. triangulifer to CECs like nanomaterials and/or microplastics (latex beads).

Current chosen western species that will need a culture method developed during this work assignment period of performance is *Tricloryithodes explicatus.(minutus)*. Eggs will be collected by collaborators and sent to the contractor. The contractor shall try to establish a healthy culture using culture methods similar to Neocloeon triangulifer.

Up to 8 different recipes for testing ecoregional reference condition water quality will be provide to the contractor by the WACOR to test short term survival and growth.

E) The contractor shall conduct the following tests at the Experimental Streams Facility:

- Bench Tox Test I – Conduct one each - 7-day Ceriodaphnia Reproduction, Fathead Larval Growth, Mayfly and Hyalella survival and growth tests.
- Ex Situ Test - Mayfly (start with 3-5 day old mayflys acclimated in ESF water) 20-25 days
- Ex Situ Test – 7-day Larval Fish & Hyalella tests
- The contractor shall provide fathead minnows and other organisms under culture or holding in the Aquatic Facilty to be tested at the ESF and AWBERC.
- The contractor shall conduct exposures with the mayfly, *Centroptilum triangulifer* upon receipt of written technical direction from the WACOR.
- The contractor shall perform toxicity tests on samples as provided and conduct ex situ exposures at ESF using standard toxicity test organisms being cultured or held in the Aquatic facility. The contractor shall conduct up to 3 tests on collected water from ESF and up to 2 ex situ tests at ESF as specified by written technical direction from the WACOR.

Deliverables:
The contractor shall prepare and submit to the WACOR a final report within 2 weeks of completion of each test.

F) The contractor conduct Sediment Toxicity Tests on Samples Collected from the USEPA National Coastal Condition Assessment (NCCA).

The contractor shall conduct a 10-day *Hyalella azteca* sediment toxicity tests on 80 samples. If sufficient

sediment volume is available, include one duplicate sample during each batch of samples tested using SOP "*Hyalella azteca* Sediment Toxicity Testing Using an Automated Renewal System."

Sampling shall be conducted between August 15-25th. Samples must be run within the SOP holding requirements of 2 months from collection. The contractor shall use the Automated diluter system and associated SOPs provided by the WACOR to conduct the following upon receipt of samples from WACOR:

For each diluter run the contractor shall use the following design:

16 samples/run + 1 duplicate + 1 control
3 runs for 48 samples
And the last run would be for only 2 samples + a duplicate. + a control = 4 samples

Contractor shall follow the following guidelines as it relates to subtask F:

Holding Time	The test must be completed within 8 weeks after sample collection. If the original test fails, then the retest also must be conducted within the 8 weeks after sample collection.	Perform test, but note reason for performing test outside holding time. EPA expects that the laboratory will exercise every effort to perform tests before the holding time expires.

Toxicity Testing: Requirements
The laboratory shall perform toxicity testing of sediment samples. Laboratories may choose to use any analysis method using the required organisms of *Hyalella azteca* (freshwater) or *Leptocheirus plumulosus* (marine). The laboratory's method must meet the quality requirements in Section 8.7, including mean survival of the control's treatments must remain greater than 80% and 90%, respectively. It is essential that the contractor require that all of its laboratory technicians use the same procedures and meet the required quality elements. At a minimum, the laboratory must:

1. Perform the procedures using the 10-day tests. Possible methods include those described in the following documents:
a. Marine: Test Method 100.4 in EPA 600/R-94/02521 or ASTM E1367-0322
b. Freshwater: Test Method 100.1 in EPA 600/R-99/06423 or ASTM E170624

2. Test the following number of replicates for each sample and control:
b. Freshwater: 4 replicates with 10 organisms per replicate

References for field and lab.

U.S. EPA. National Coastal Condition Assessment Quality Assurance Project Plan. United States Environmental Protection Agency, Office of Water, Office of Wetlands, Oceans and Watersheds. Washington, D.C. *EPA 841-R-14-005*. 2014.

USEPA. National Coastal Condition Assessment 2015: Laboratory Operations Manual. EPA-841-R-14-008. U.S. Environmental Protection Agency, Office of Water, Washington, DC. 2014.

USEPA. 2014. National Coastal Condition Assessment: Field Operations Manual. EPA-841-R-14-007. U.S. Environmental Protection Agency, Washington, DC.

The contractor shall prepare a final report (report format will be provided by WACOR) describing the experiments conducted under this task by 9/25/16 and submit to WACOR.

Task 4: Conduct Toxicity Tests on Algal Toxins

The contractor shall test reference toxin standards for microcystins, cylindrospermopsin, anatoxin-a., prymnesins and euglenophycin using standard acute, sub chronic and chronic testing methods for *Ceriodaphnia dubia, Daphnia magna, Hyalella Azteca* and larval *Pimephales promelas*. In addition, using the same toxin standards, the contractor shall test a new EPA test species, a baetid mayfly, *Neocloeon triangulifer*.

The contractor shall:

- Conduct 3 forty eight hour tests using 4-5 concentrations of each toxin with *C dubia, D magna* and *N triangulifer*.
- Conduct 3 ninety six hour tests using 4-5 concentrations of toxin with *H azteca* and *P promelas*.
- Conduct 3 seven day chronic and sub chronic tests using 4-5 concentrations of each reference toxin with *C dubia* (7-day fecundity test), *N triangulifer* (7-day growth) and *P promelas* (7-day growth tests). Conduct 3 ten day tests using 4-5 concentrations of each toxin with *H azteca* (10-day growth) and *D magna* (2 brood fecundity test).

Upon completion of the acute and chronic tests, the contractor shall conduct mixture testing that reflect the predominant co-occurring species and generate IC10s or 20s for such mixtures. The contractor shall generate LC50s and IC10 or 20s for each chronic and sub chronic test species. Generate IC20s for toxin mixtures.

Deliverables:
A final report shall be prepared within 2 weeks of completion of each test.

Task 5: Processing and Identification of Zooplankton

There are several projects in which Zooplankton will be collected via Wisconsin Zooplankton nets and put into sample containers. Samples will be provided to the contractor for sorting and for the zooplankton to be identified. The samples will be from Lake Harsha and the Ohio River.

The contractor shall process samples and identified Zooplankton using 95% alcohol for DNA barcoding ID.

The contractor may identify Zooplankton using "An Imaged Based Key to North American Zooplankton Species version 5.0". http://cfb.unh.edu/cfbkey/html/index.html.

The contractor shall prepare an identification report on up to 15 samples provided by WACOR.

Task 6: Periphyton Sampling and Processing

The contractor shall conduct "Field" Sampling of Periphyton at the Experimental Stream Facilities (ESF) in Milford, OH. Sampling at ESF shall include collection and scraping periphyton tiles, filtering Chlorophyll a and ash free dry mass (AFDM) from the samples, and preserving periphyton samples. This sampling shall occur once bi-weekly from July 1 through November 2016 (i.e., approximately 16

sampling events); however, sampling cannot occur outside of the period of performance of this work assignment. Any sampling events scheduled outside of the period of performance of this work assignment are contingent upon exercise of Option Period 1 and the issuance of a work assignment from the Contracting Officer. For planning purposes, the contractor should be prepared for **12** sampling events from July 1 – September 29. The contractor shall conduct sampling, processing, preparation, and associated data management of stream periphyton and/or water column samples for algal and/or bacterial biomass indicators, algae enumeration, identification, and biovolume estimation from samples obtained at ESF or field sites.

The EPA estimates @ 90 samples from ESF for algal ID and 500 Algal Id samples between July 1 and September 29 (includes ESF periphyton, Harsha Lake and Regional survey of methane emissions from reservoirs sites).

The Contractor shall conduct lab work at AWBERC on the samples collected at each ESF sampling event. The lab work shall occur the day after the sampling activities at the ESF with the exception that the algae sample filters shall be placed in a drying oven the day they were collected. Activities at AWBERC may include drying, combusting, and weighing algae sample filters, staining and counting of bacteria using epifluorescence microscopy, cleaning of glassware used during experiment, and data entry into Microsoft Excel.

Deliverables:
Complete up to 12 ESF sampling events, including sample preparation at AWBERC, sampling activities at the ESF and lab work at AWBERC.
Data shall be delivered to the WACOR on completion of each sampling event.

Task 7: Periphyton Sample Tracking, Preparation, Identification and Counting, and Measurement of Algal Biovolume

(A) Sample Tracking Procedures: The Contractor shall process algal samples as requested by written technical direction from the WACOR and use a unique sample ID to track these samples.

(B) Diatom and Soft Algal Sample Identification and Enumeration: All algal identification and enumeration shall be conducted under approved SOPs (provided under task 1).

(C) Biovolume Measurements of Diatoms and Soft Algae Samples: All algal biovolume measurements shall be conducted according to approved SOPs (that will be provided under task 1) or guidelines provided by the WACOR.

(D) Data Entry and QC: The algal data shall be entered into Microsoft Excel and/or ACCESS and made available on the share drive to the WACOR and PI within a time specified by the WACOR via written technical direction. All sample processing and identification of specimens, tracking, management of records and sample analysis data, as well as QA/QC checks of data shall be maintained by the Contractor in log books and in electronic format. This includes QC checks, validating the integrity of data input, correcting data errors, performing database queries and retrievals. The Contractor shall verify data accuracy and completeness according to approved SOPs provided under Task 1. All data and materials developed as a part of the Work Assignment shall be released by the Contractor to the WACOR upon request.

Deliverables: Algae data and indices, and reports

QA/QC: ID for QA of external labs:

Task 8: Phytoplankton ID and Enumeration

The contractor shall identify and enumerate phytoplankton collected from EPA Harmful Algal Blooms HABs Project lakes. The contractor may identify/enumerate 50-100 samples. It may be necessary to modify the existing SOP (will be provided to the contractor under Task 1). If a modification is necessary the contractor will be notified via written technical direction from the EPA WACOR.

Deliverable: Summarize services in contract required monthly progress report

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-65

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	09/30/2015 To 09/29/2016 Base X Option Period Number	Cell Culture and Molecular Bio

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	Section 4 (SOW): sub sections D.2, D.3, and F.1.

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

Period of Performance: From 09/30/2015 To 09/29/2016

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

	Cost/Fee:	LOE:
Contract Period: 09/30/2015 To 09/29/2016		0
This Action:		0
Total:		0

Work Plan / Cost Estimate Approvals

	Cost/Fee	LOE:
Contractor WP Dated:		
Cumulative Approved:		

Work Assignment Manager Name Michael Ware	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-569-7731 FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code: Phone Number: 513-569-7196 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

EPA Contract No.: EP-C-15-010
Work Assignment No.: 0-65

Title: Cell Culture and Molecular Biology Support

Work Assignment Contracting Officer Representative (WACOR):
Michael Ware
513-569-7731
ware.michael@epa.gov

Alternate WACOR:
Jim Owens
513-569-7235
Owens.jim@epa.gov

Period of Performance:
TASK 1 ONLY: CO Issuance thru September 29, 2016
TASKS 2 – 3: July 1, 2016 – September 29, 2016

Level of Effort:
540 Hours

Location: AWBERC

Goals
The goals of this work assignment are to support National Exposure Research Laboratoy (NERL) Exposure Methods and Measurements and Systems Exposure Divisions (EMMD and SED) research by 1) preparing media and maintaining the cell culture lines and 2) to providing support for microbiological and molecular biology for various projects.

BACKGROUND/OBJECTIVES
Propagation of some enteric viruses and protozoan parasites as well as measurement of their occurrence and/ or viability is possible through the use of continuous cell culture lines. Infection and/or exposure can observed through several different mechanisms including cytopathic effect (CPE), plaque assay, immunofluorescent staining, microscopy, and gene response. Continuous cell lines are a simpler and cheaper than animal or human models for measuring exposure and/ or infection. In order to measure the occurrence, recovery, and/ or infection status of these microorganisms, cell culture is a necessary component of several US EPA research projects.

EMMD and SED use multiple sample preparation and molecular biology techniques for various pathogenic microorganisms. This work assignment will support these efforts by

performing sample prep, DNA and RNA extractions, PCR, RT-PCR, qPCR, RT-qPCR, cloning, droplet digital PCR (ddPCR), MiSeq library preparation, protein assays, and next generation sequencing using EPA provided protocols.

Task 1: Orientation

The contractor shall attend a facilities orientation with the EPA WACOR. During the orientation, the WACOR and the contractor will discuss the information provided in Table 1 (various Cell Culture SOPs) as well as the Parasite and Viral Cell Culture Health and Safety Plan.

The EPA anticipates that the contractor will need to attend the orientation prior to work plan submission in order to have the best understanding for technical approach for completing the WA PWS tasks.

Table 1. Cell Culture SOPs

Tracking Number	Alternate ID/ Tracking Number	Branch	SOP Steward	Title
D-EMMD-MEB-002-SOP-01	BARB-122.4	MEB	Mike Ware	Large-Scale Culture of BGM Cells
D-EMMD-MEB-003-SOP-01	BARB-123.4	MEB	Mike Ware	Culture and Maintenance of Cell Lines
D-EMMD-MEB-004-SOP-01	BARB-124.2	MEB	Mike Ware	Production of Cell Culture Media
D-EMMD-MEB-005-SOP-01	BARB-125.0	MEB	Mike Ware	The Preparation of Cell Lines for Freezing and Storage

Task Deliverables:

Orientation (including submission of work plan) within 15 days of work assignment issuance.

<u>Start date for Tasks 2 and 3 is July 1, 2016</u>

Task 2: Cell Culture Preparation and Maintenance

1. The contractor shall prepare all media and reagents necessary for cell culture maintenance and/or test culture orders. The contractor shall perform Quality Assurance (QA) checks of each batch of media made for bacterial contamination using aerobic and anaerobic conditions.
2. On a weekly schedule, the contractor shall maintain the following cell lines: Buffalo Green Monkey Kidney (BGM) and *Homo sapien* lung carcinoma (A549), and change the media for BGM stock cultures (ie: passage on Mon. and change media on Thurs.). For each passage, the contractor shall document the cell count, split ratio, the aerobic and anaerobic results of spent media, and media information including formulations, suppliers, and lot numbers. In addition, an undisturbed back-up flask (flask passaged

the previous week) shall be retained in the incubator. Once established, any deviations from the schedule shall be approved by the WACOR.

3. If requested by a WACOR issued written technical directive, the contractor shall provide test cultures for an EPA investigator (PI). Within 2 working days, the contractor shall notify the WACOR by email with copy to the PI when the test cultures should be available. Upon completion, the contractor shall notify both the WACOR and PI by email, and provide the passage number, split ratio, cell count, and viability ratio. The preparation of test cultures will add no more than 2 hours to the weekly passage/feeding time, and it is anticipated that test cultures will be required no more than once a month.
4. Upon receipt of written technical direction from the WACOR, the contractor shall revive cryopreserved cell lines. Upon successful revival, the contractor shall cryopreserve aliquots of the next few passages. A spreadsheet for the frozen stock inventory shall be maintained for each cell line. Cell cryopreservation and revival will only be requested if there is contamination or a very high passage number.
5. The contractor shall perform mycoplasma testing monthly on all cell lines. Results shall be recorded in a spreadsheet.
6. **The contractor shall immediately notify the WACOR of any problems with cultures or tasks** (i.e. contamination events, QA/QC problems, cell death, inability to prepare test cultures) via email. In the email, the contractor shall specify the actions to remedy the situation and prevent future events.
7. All results shall be recorded in notebooks and on-line spreadsheets.
8. The contractor shall maintain an inventory of cell culture supplies and report needed supplies to the WACOR at least two weeks prior to the date when the supplies will be needed.
9. If only one individual is performing the cell culture maintenance, the contractor shall train another individual as a backup.
10. Upon written technical direction of the WACOR the contractor may propagate and prepare stock virus or protozoa, other stock cell lines, or assay samples for infectivity or viability by plaque assays, quantal assays, or immunofluorescence assays. The EPA WACOR will provide protocols/methods to the contractor. Upon completion, the contractor shall email a copy of the completed protocol to the WACOR and PI.
11. The contractor shall be responsible for avoiding contamination of samples (surface or air borne). On a weekly basis, the contractor shall wipe countertops in room 360 with 70% ethanol to remove any residue from those surfaces, as well as mop the floor to prevent any potential debris from becoming airborne.

Task 2 Deliverables:

Records (in the form of contractor lab notebooks and electronic copies) of media preparation, cell maintenance, test culture preparation, and QA/QC results shall be submitted to the WACOR monthly for review. Biweekly updates shall be presented to WACOR regarding supplies which are anticipated to be needed to be provided by the EPA.

Task 3: Sample Preparation, PCR, Cloning, Microarray, Protein Work, and Next Gen Sequencing

1. Upon receipt of written technical direction from the WACOR, the contractor shall perform microbial and or molecular services for EMMD and SED. These services shall include but are not limited to nucleic acid extractions and/or purifications, PCR, RT-PCR, qPCR, RTqPCR, ddPCR, RT-ddPCR, gel or e-gel electrophoresis, MiSeq protocols, cloning, preparation of clones for sequencing, and protein assays such as protein quantitation assays, SDS-PAGE gels, western blotting, 2-D gels, and other protein detection assays. It is anticipated that 1-4 technical directives will be issued a month ranging from 4 hours to 30 hours to complete; some technical directives may take weeks to complete.
2. Protocols and supply/reagent location for any task will be provided by EPA in the technical directive.

Task 3 Deliverables:
A completed protocol will be uploaded to the a shared drive and a notification sent by email to the WACOR with copy to any appropriate PI, as well as the location of final sample concentrates, data files containing gel images, qPCR, RT-qPCR, ddPCR and/or RTddPCR data, clones and their sequences, MiSeq data (data storage will be provided), and protein assay data.

SAFETY CONSIDERATIONS
Cell culture must be performed in a biosafety cabinet to protect the cultures. In rare cases, some cell lines are known to contain viral contaminants. In addition, pathogenic microorganisms such as viruses and protozoan parasites will be routinely handled. The contractor is responsible for following approved Health and Safety plans, and must rigorously follow the guidelines on sterilization and aseptic technique. An adequate safety plan will include the appropriate safety precautions described in Biosafety in Microbiological and Biomedical Laboratories (Publication No. (CDC) 21-1112, U.S. Department of Health and Human Services, Washington, D.C.).

Meetings between the contractor and the WACOR may occur to discuss progress and technical difficulties on an as-needed basis. Changes in procedures to overcome technical difficulties can be made by mutual agreement between the contractor and the WACOR. Any changes to procedures that are outside of the scope of the PWS or should change the cost will be issues via Amendment to the Work Assignment. EPA also may conduct quality assurance audits of the contractor's laboratory.

ACCEPTANCE PROCEDURE FOR DELIVERABLES
A notification of completion for all deliverables shall be sent by the WACOR. The WACOR will advise the contractor of any problems with deliverables within 1 week after receipt. The contractor shall submit the revised deliverable within 3 calendar days after receipt of the WACOR's comments.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-65

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	09/30/2015 To 09/29/2017 Base X Option Period Number	Cell Culture support

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	4.E.3, 4.F.1, F.4.3, and 4.H

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

Period of Performance: From 09/30/2015 To 09/29/2016

Comments:
The purpose of this amendment is to add tasks 4, 5, and 6. All other tasks and deliverables 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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Authorized Work Assignment Ceiling

Contract Period: 09/30/2015 To 09/29/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Michael Ware	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7731 FAX Number:
Project Officer Name Michael Moeykens	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7196 FAX Number:
Other Agency Official Name Nichole Brinkman	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7315 FAX Number:
Contracting Official Name Candice Charlton	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-487-2007 FAX Number:

Performance Work Statement

EPA Contract No.: EP-C-15-010
Work Assignment No.: 0-65, Amendment 1

Title: Cell Culture and Molecular Biology Support

Work Assignment Contracting Officer Representative (WACOR):
Michael Ware
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Alternate WACOR:
Jim Owens
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Period of Performance:
Task 1 ONLY: CO Issuance – September 29, 2016
Tasks 2-3: July 1, 2016 – September 29, 2016
Tasks 4 -6: August 22, 2016 - September 29, 2016

LOE: 540 hours
LOE Amendment 1: 250 hours

Purpose:

The purpose of this amendment is to add three new Tasks, 4, 5, and 6. All other tasks and outputs remain the same.

Task 4: Receipt and Processing of Environmental Samples
As requested by the WACOR through written technical directives containing all protocols, the contractor shall track and process environmental samples transported to the EPA. These sample processing techniques include, but are not limited to, elution of filters, such as hollow fiber ultrafilters and sterivex filter units, elution of suspended particles, membrane filtration, density flotation, or chemical extractions. Generally, processed samples shall be analyzed using the molecular analytical techniques described in Task 3. Protocols will be provided within the technical directives which will also include molecular processing and analysis as described in task 3. It is anticipated that 1-4 technical directives will be issued a month ranging from 4 hours to 30 hours to complete; some technical directives may take weeks to complete.

Task 4 Deliverables:
A completed protocol will be uploaded to a shared drive (specified by the WACOR) and a notification sent by email to the PI and the WACOR as well as the location of final sample concentrates, data files containing gel images, qPCR, RT-qPCR, ddPCR and/or RTddPCR data,

clones and their sequences, MiSeq data (EPA PI must provide data storage), and protein assay data.

Task 5: Data Analysis and Assistance in Manuscript Preparation
As requested by the WACOR through written technical directives, the contractor shall perform analysis of data generated from processing and analytical techniques described in Task 3 and 4, including, but not limited to qPCR, ddPCR and sequence data. In addition, the contractor shall assist in preparing manuscripts and/or reports as described by technical directives issued by the WACOR. It is anticipated that 1-4 technical directives will be issued a month ranging from 4 hours to 30 hours to complete; some technical directives may take weeks to complete. The contractor shall be given authorship if the ORD authorship criteria are met.

Task 5 Deliverables:
Details of steps used to analyze data shall be recorded in an appropriate document (e.g., Microsoft Word, R markdown, etc.) and saved to the share drive, along with any files generated from data analysis. Drafts of manuscripts or reports will also be saved to the share drive.

Task 6: Evaluate Small-scale Water Treatment Strategies to meet Log Reduction Targets of Decentralized Non-potable Water Systems
As requested by the WACOR through written technical directives containing all protocols, the contractor shall implement and evaluate small scale treatment options to reduce microbial risk in graywater systems, including the AWBERC pilot system. The treatment scenarios include, but are not limited to, filtration, membrane bioreactors and disinfection. In addition, the contractor shall evaluate the performance of the treatment unit implemented by collecting samples before and after treatment, adding preservatives as needed and performing analysis of selected physical, chemical and biological parameters, including but not limited to, fecal indicator organisms, chemical oxygen demand, Total Kjeldahl nitrogen, turbidity and fluorescence spectroscopy. Protocols will be provided within the technical directives. It is anticipated that 1-4 technical directives will be issued a month ranging from 4 hours to 30 hours to complete; some technical directives may take weeks to complete.

Task 6 Deliverables:
Completed protocols shall be uploaded to the shared drive and a notification sent by email to the PI and the WACOR. Location of samples and data files shall be included in the email.

Performance Work Statement

Title: **Development of methods for assessing tissue levels of Algal Toxins in Aquatic Food Webs.**

Period of Performance: CO Issuance through September 29, 2016

Contract Number: EP-C-15-010

Work Assignment Number: 0-69

Work Assignment COR: Jim Lazorchak

Alternate WACOR: Chris Impellitteri

Research Location: U.S. EPA, 26 W. Martin Luther King Dr., Cincinnati, Ohio 45268

LOE: 1510

Background:

There are limited methods for the analyses of multiple algal toxins in aquatic food webs, phytoplankton, zooplankton, periphyton, macroinvertebrates, forage fish, bottom feeders and top carnivore fish. Algal toxins in freshwater systems do not necessarily occur in single toxin concentrations, there are mixtures of toxins from Cyanobacteria, *Prymnesium parvum (Prymnesins)*, and *Euglena sanguinea* (microcystins, cylindrospermopsin, anatoxin-a., prymnesins and euglenophycin). The objective of this research is to develop a method capable of analyzing edible fish, plant or animal tissues for multiple toxins and test such methods on reservoir, stream and coastal food webs. There are also analytical methods being developed for mouse fur and muscle tissues by EPA laboratories in Las Vegas and RTP for microcystins (M-LR, M-RR, M-LF and M-LA congeners), cylindrospermopsin, anatoxin-a, saxitoxin(s) (paralytic shellfish poison), domoic acid (amnesic shellfish poison), okadaic acid (diarrhetic shellfish poison), and brevetoxin (neurotoxic shellfish poison). The first three are freshwater, saxitoxin(s) are both freshwater and marine, and the last three are primarily marine. Extraction methods and analyses methods being developed for this later activity will be a starting point for developing methods for aquatic plants and organisms under this work assignment.

The developed methods intended user/customer/audience are: Regions, States, Tribes, Public Health Officials and Public Health Laboratories.

Task Descriptions

Work shall not begin on the below tasks until the developed QAPP for this project has been reviewed and approved by the appropriate contractors as designated on the review and approval page. Please refer to Quality Assurance Section below.

Task 1: Review of Existing Methodologies
The contractor shall perform a literature review and interact with current algal toxin researchers to document existing methods for analyzing algal toxins in aquatic food webs, phytoplankton, zooplankton, periphyton, macroinvertebrates, forage fish, bottom feeders and top carnivore fish.

Deliverable: Report on existing algal toxin analysis methods (September 29, 2016)

Task 2: Analytical Method Development
The contractor shall develop analytical methods for measuring cyanobacteria and algal toxins in fish fillets, plant and animal tissues using methods developed for water as a starting point. For developed methods, tissues shall be spiked with available toxin standards or develop new standards and develop MDS (Minimum Detectable Signals) using various concentrations that simulate below and at reported ambient concentrations found in Task 4.01A.

Deliverable: Summary of initial results of method development (September 29, 2016) & final SOP for extraction method.

Task 3: Analysis of field study samples

The contractor shall use the developed methods for analysis of phytoplankton, zooplankton, macroinvertebrate and various trophic levels of fish collected from field study areas (e.g., Harsha Lake, Ohio, Southwestern Lake Erie, Texas and Oklahoma Reservoirs). Standard toxin spiked tissues shall be incorporated into these studies. For top carnivore fish, both edible tissues, muscle as well as liver, shall be assessed.

30 fish samples – 5 fish from each of the following trophic levels

Top Carnivore
Plankton feeder
Sucker
Bottom Feeder
Minnow
Sunfish

10 phytoplankton samples
10 zooplankton samples
10 periphyton samples
10 macroinvertebrate samples

Deliverable:

Report on the analytical results of food web samples collected from Harsha or Lake Erie, September 29, 2016

The contractor shall furnish personnel, services, and supplies necessary to support research develop plant and animal toxin methods. Tissues to be used by the contractor for the tasks 2 & 3 will come from collections made by the WACOR and other collaborators. The contractor shall first develop tissue methods for fish fillets and whole fish. The contractor shall prepare homogenates or if already available, spiked with various toxin standards that are available. The contractor shall evaluate single toxins first, then mixed together, and extraction efficiency evaluated. The contractor with coordination from the TOCOR will coordinate methods development with EPA chemists in Las Vegas, Charlita Rosal, and RTP.

Written Technical direction regarding sample preparation, chemical analyses, method will be provided by the EPA Work Assignment COR (WACOR).

The contractor shall provide monthly reports on all aspects of the project(s). Additional meetings and reporting may be requested, on an as needed basis, by the WACOR to determine the progress of the project(s) and/or achievement of interim experimental goals. The contractor shall provide written materials, graphs, data analyses, slides, etc. on an as needed basis, as determined by the WACOR through written technical direction, to be used in presentations, publications, etc. regarding the progress/results of the project(s).

Quality Assurance

A Quality Assurance Project Plan entitled "Method Development for Assessing Tissue Levels of Algal Toxins in Aquatic Food Webs" is currently in development by the WACOR. This QAPP is intended to cover the work described in this performance work statement and will be provided to the contractor by the WACOR for their review and approval. Work will not begin on this work assignment until the contractor have reviewed and approved the finalized QAPP.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-69

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	09/30/2015 To 09/29/2017 Base X Option Period Number	: Development of methods for

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	Tasks 2-3

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

Period of Performance: From 02/10/2016 To 09/29/2016

Comments:
Amendment to de-scope the PWS to remove the development of an analytical method.

☐ 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: 09/30/2015 To 09/29/2017 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Jim Lazorchak	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7076 FAX Number:
Project Officer Name Michael Moeykens	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7196 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
EPC15010
WA 0-69, Amendment 1

Title: **Development of methods for assessing tissue levels of Algal Toxins in Aquatic Food Webs.**

Period of Performance: CO Issuance through September 29, 2016

Work Assignment COR: Jim Lazorchak
Alternate WACOR: Chris Impellitteri
Research Location: U.S. EPA, 26 W. Martin Luther King Dr., Cincinnati, Ohio 45268

Purpose

The purpose of this amendment is to focus the PWS on the development of extraction methods and de-scope the development of an analytical method. All changes are highlighted below.

Background:

There are limited methods for the analyses of multiple algal toxins in aquatic food webs, phytoplankton, zooplankton, periphyton, macroinvertebrates, forage fish, bottom feeders and top carnivore fish. Algal toxins in freshwater systems do not necessarily occur in single toxin concentrations, there are mixtures of toxins from Cyanobacteria, *Prymnesium parvum (Prymnesins)*, and *Euglena sanguinea* (microcystins, cylindrospermopsin, anatoxin-a., prymnesins and euglenophycin). The objective of this research is to develop an extraction method capable of analyzing edible fish, whole fish, plant or animal tissues for multiple toxins and test such methods on reservoir, stream and coastal food webs. There are analytical methods being developed for mouse fur and muscle tissues by EPA laboratories in Las Vegas and RTP for microcystins (M-LR, M-RR, M-LF and M-LA congeners), cylindrospermopsin, anatoxin-a, saxitoxin(s) (paralytic shellfish poison), domoic acid (amnesic shellfish poison), okadaic acid (diarrhetic shellfish poison), and brevetoxin (neurotoxic shellfish poison). The first three are freshwater, saxitoxin(s) are both freshwater and marine, and the last three are primarily marine. Extraction methods and analyses methods being developed for this later activity will be a starting point for developing extraction methods for aquatic plants and organisms under this work assignment.

The developed extraction methods intended user/customer/audience are: Regions, States, Tribes, Public Health Officials and Public Health Laboratories.

Task Descriptions

Work shall not begin on the below tasks until the developed QAPP for this project has been reviewed and approved by the appropriate contractors as designated on the review and approval page. Please refer to Quality Assurance Section below.

Task 1: Review of Existing Methodologies
The contractor shall perform a literature review and interact with current algal toxin researchers to document existing extraction and analytical methods for analyzing algal toxins in aquatic food webs, phytoplankton, zooplankton, periphyton, macroinvertebrates, forage fish, bottom feeders and top carnivore fish.

Deliverable: Report on existing algal toxin analysis methods (September 29, 2016)

Task 2: ~~Analytical Method Development~~Development of extraction methods
The contractor shall develop ~~danalytical metho~~s extraction methods for measuring cyanobacteria and algal toxins in fish fillets, whole fish, plant and animal tissues using methods developed for water as a starting point. ~~For developed methods,~~ Tissues shall be spiked with available toxin standards or develop new standards and develop MDS (Minimum Detectable Signals) using various concentrations that simulate below and at reported ambient concentrations found in Task 4.01A.

Deliverable: Summary of initial results of method development (September 29, 2016) & final SOP for extraction method.

Task 3: Extraction of field study samples

The contractor shall use the developed extraction methods for analysis of phytoplankton, zooplankton, macroinvertebrate and various trophic levels of fish collected from field study areas (e.g., Harsha Lake, Ohio, Southwestern Lake Erie, Texas and Oklahoma Reservoirs). Standard toxin spiked tissues shall be incorporated into these studies. For top carnivore fish, whole fish, edible tissues, muscle as well as liver, shall be assessed.

30 fish samples – 5 fish from each of the following trophic levels

Top Carnivore
Plankton feeder
Sucker
Bottom Feeder
Minnow
Sunfish

10 phytoplankton samples
10 zooplankton samples
10 periphyton samples
10 macroinvertebrate samples

Deliverable:

Report on the extraction efficiency results of food web samples collected from Harsha or Lake Erie, September 29, 2016

The contractor shall furnish personnel, services, and supplies necessary to support research develop plant and animal toxin methods. Tissues to be used by the contractor for the tasks 2 & 3 will come from collections made by the WACOR and other collaborators. The contractor shall first develop tissue extraction methods for fish fillets and whole fish. The contractor shall prepare homogenates or if already

available, spiked with various toxin standards that are available. The contractor shall evaluate single toxins first, then mixed together, and extraction efficiency evaluated. The contractor with coordination from the TOCOR will coordinate methods development with EPA chemists in Las Vegas, Charlita Rosal, and RTP. Analyses of extracts will be conducted by the technical advisory, Dr Toby Sanan.

Written Technical direction regarding sample preparation, , extraction method will be provided by the EPA Work Assignment COR (WACOR).

The contractor shall provide monthly reports on all aspects of the project(s). Additional meetings and reporting may be requested, on an as needed basis, by the WACOR to determine the progress of the project(s) and/or achievement of interim experimental goals. The contractor shall provide written materials, graphs, data analyses, slides, etc. on an as needed basis, as determined by the WACOR through written technical direction, to be used in presentations, publications, etc. regarding the progress/results of the project(s).

Quality Assurance

A Quality Assurance Project Plan entitled "Method Development for Assessing Tissue Levels of Algal Toxins in Aquatic Food Webs" is currently in development by the WACOR. This QAPP is intended to cover the work described in this performance work statement and will be provided to the contractor by the WACOR for their review and approval. Work will not begin on this work assignment until the contractor have reviewed and approved the finalized QAPP.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-70

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	To	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X	Option Period Number	Ecological Exposure Chemistry

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	4 E

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

Period of Performance: From 10/02/2015 To 09/29/2016

Comments:
The contractor shall immediately start work on all tasks listed in the Work Assignment Performance Work Statement.

☐ 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 (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: To — 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 Greg Toth	(Signature)	(Date)	Branch/Mail Code:
			Phone Number 513-569-7242
			FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7196
			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:

Contract No. EP-C-15-010
Work Assignment 0-70
PERFORMANCE WORK STATEMENT

TITLE: Ecological exposure chemistry

Work Assignment Contracting Officer's Representative (WACOR):

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Alternate WACOR:

Denise A. Gordon
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Period of Performance: CO Issuance through September 29, 2016

Task 1.0 quality management plan
Guidance for the work assignment QMP should be obtained from the contractor's QA officer or the EPA WA-COR. The general QMP guidance document (QA-R-2) can be found at http://www.epa.gov/quality/qmps.html. QA requirements for specific procedures are detailed in SOPs as needed.
Deliverable:

Quality management plan by October 30, 2015

Task 1.1 Pesticide Mixtures Exposure Study Phase II
The contractor shall perform the simultaneous analysis of 4 pyrethroid pesticides (permethrin, bifenthrin, cypermethrin, and esfenvalerate) and/or other chemicals in laboratory and/or field exposed aqueous samples. For this work assignment the contractor shall analyze approximately 250 aqueous samples. These samples will likely consist of three 72 hour exposures with at least six sets of conditions performed in triplicate (for a total of 18 samples a day for four days). Dates of exposures will be determined by the EPA WACOR via written technical direction. The contractor shall start and finish exposures no less than two weeks apart. Stock solutions for the pesticides used in dosing for the exposures shall also be prepared by the contractor prior to the start of the exposure studies and analyzed for accuracy before and after the exposures. The analysis method currently being used includes solid phase extraction of aqueous samples with HLB SPE cartridges followed by single quadrupole GC/MS analysis and/or other, more sensitive methods. The contractor shall utilize the attached document "MIRB-349.1E Pesticides in water by GC-MS.docx" for details on sample preparation, analysis and specifics on the type of QC samples and the QC acceptance limits. The contractor shall also perform analysis on approximately 150 samples for pyrethroid pesticides when exposure co-occurs with metals exposure.

Task 1.2 Effects of Nutrients on Wetland Communities and Functions

The contractor shall analyze approximately 80 soil samples from isolated wetlands for total phosphorus (TP), total nitrogen (TN), and organic matter (OM). Soil samples shall be first prepared by the attached draft MIRB SOP "INITIAL PREPARATION OF SOIL SAMPLES AND DETERMINATION OF SOIL ORGANIC MATTER BY LOSS ON IGNITION" and then analyzed for Total Nitrogen (TN), Total Phosphorus (TP), and Soil Organic Matter (SOM) using the aforementioned MIRB SOP for soil organic matter determination by loss on ignition, the Total P digestion SOP (ESF-SOP-020-TP on Solid Samples) and the Total N analysis SOP (PTS IRMS.03_C and or N Isotop Ratio Analses by EA-IRMS_20110829). Dry samples measures should be taken rather than wet sample measures and the data on the different fractions of N and P in the soil should also be collected. The contractor shall complete an Initial Demonstration of Capability prior to the analysis of any real samples.

Task 1.3 Semi Annual testing of Labline Water and Synthetic Water – The contractor shall test three samples (Labline, MHRW, and MiliQ water) twice a year for the presence of Al, As, Cr, Co, Cu, Fe, Pb, Ni, Zn, Cd, Hg, and Ag metals, and organochlorine pesticides and PCBs. The contractor shall provide the EPA WACOR with SOPs for approval prior to sample analysis for this task.

Task 1.4 Metals exposure study

The contractor shall perform the simultaneous analysis of up to 4 metals (to be determined by the EPA WACOR via written technical direction, but possibly including aluminum, cadmium, copper, mercury, selenium, or silver) in laboratory and/or field exposed aqueous samples. The contractor shall expect to measure the total and/or dissolved metals. This analysis may be combined with other chemicals (e.g. pesticides) as part of a mixtures study. The contractor shall analyze not more than 400 water samples, although the actual number is anticipated to be around 200-300 or less. These samples will likely consist of 0, 24, and 48 hour exposures with six sets of conditions performed in triplicate for a total of 6, 24, and 18 samples a day, respectively. Dates of exposures have not been determined, but are not expected to begin earlier than Jan 2016. The EPA WACOR will provide written technical direction to start exposures. Start and finish of each metal exposure should be no less than a week apart and probably not more than 8 weeks total from start to finish. Stock solutions for the metals used in dosing for the exposures shall also be prepared by the contractor prior to the start of the exposure studies and analyzed for accuracy before and after the exposures. The analysis method currently being used includes using microwave digestion for total metals followed by ICP/AES, GFAA, flame AA and/or other more sensitive methods. The contractor shall utilize EPA Methods 6010B, 6010C, 7000b, 7010 or 200.7 or an equivalent for all analyses. The contractor shall refer to the appropriate method for details on sample preparation, analysis, and specifics on the type of QC samples and the QC acceptance limits. The contractor shall provide the EPA WACOR with SOPs for approval prior to sample analysis for this task.

Task 1.5 Unknown Contaminant Screening Primarily using LC-ToF

The Molecular Ecology Research Branch (within ORD/NERL/EERD) is working on developing non-targeted chemical screening tools to examine broad ranges of possible chemical contaminants present in environmental samples using liquid chromatography and time of flight mass spectrometry (LC-ToF). The contractor shall develop a set of method conditions following

written technical directive from the EPA WACOR, involving both instrumental and sample preparation, to screen water and possibly fish tissue samples for targeted and non-targeted analytes. The contractor shall test and compare several sample preparation techniques for water and possibly fish tissue. This may include solid phase extraction, liquid-liquid extraction, large volume direct injection, or accelerated solvent extraction. The contractor shall develop the primary analysis method on a Waters Xevo LC-ToF. Please note that a LC triple quadrupole and GC ion trap are also available to compliment the analysis.

Field samples for wastewater, surface water, and drinking water may also be collected and screened for contaminants.

Quality Assurance Auditing
The EPA staff, through the EPA WACOR, reserves the right to conduct a technical systems audit of the laboratories, records, and staff of this work assignment as per the NERL Quality Management Plan once during the work assignment period of performance.

Output Summary

- Analyses for 4 pyrethroid chemicals in 400 aqueous samples for two separate experiments (250 + 150)
- Analyses for total phosphorus (TP), total nitrogen (TN), and organic matter (OM) in approximately 80 soil samples from isolated wetlands
- Analyses for pesticides, PCBs, PBDEs and lipids in approximately 112 whole fish samples that were previously homogenized Semiannual analyses of 3 lab water samples for presence of Al, As, Cr, Co, Cu, Fe, Pb, Ni, Zn, Cd, Hg, and Ag metals, and organochlorine pesticides and PCBs
- Analyses for 4 metals yet to be named in aqueous samples
- Method conditions and an SOP for the non-targeted screening analysis of water and possibly fish tissue samples.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-73

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	To	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X	Option Period Number	Research Laboratory Support

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	4E (1, 2), 4H(1, 2, 3, 5, 11, 12)

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

Period of Performance: From 10/12/2015 To 09/30/2016

Comments:
The contractor shall immediately start work on all tasks listed in the Work Assignment Performance Work Statement.

☐ 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 (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: To — 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 Todd Luxton	(Signature)	(Date)	Branch/Mail Code:
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			FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7196
			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
EPA Contract No.: EP-C-15-010
Work Assignment: 0-73

Title: Research Laboratory Support for the Characterization and Fate of Nanoparticles and soils and Sediment Analysis

Work Assignment Contracting Officer's Representative:
Name: Todd Luxton
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Alt. Work Assignment Contracting Officer's Representative:
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Period of Performance: September 30, 2015 – September 29, 2016

The current objective of this work assignment will be to: 1) Aid in the development of protocols for the characterization of ENMs in complex media, 2) Aid in developing protocols for evaluating the release of ENMs under environmental conditions, 3) Identify relationships between physicochemical properties and the fate and exposure of ENMs, 4) Provide laboratory support for the processing and of soil, sediment, and water samples, and 5) provide general support for laboratory upkeep and maintenance.

BACKGROUND

Environmental impacts due to ENMs arise both from their synthesis precursors and release from products and applications. Defining the route and magnitude of exposure to nanomaterials, via release (accidental or intentional), transport, and transformation is fundamental to understanding their environmental risks. Release studies estimate the environmental discharge of ENMs that may occur through use and application along with their eventual disposal/release to wastewater treatment facilities, landfills, incineration, recycling and/or terrestrial ecosystems. A portion of ENMs released will make their way into aquatic ecosystems, though the extent of nanomaterial migration depends heavily on physicochemical interactions with surrounding environmental media, environmental and biological transformations, and environmental management policies established to reduce risk to humans and the ecosystem. Verified methods and protocols for measuring and quantifying changes in physicochemical properties such as dispersion, surface reactivity, and transformations among others in Use and Disposal life cycle stages will enhance the ability of EPA to regulate ENMs and better predict their impact on human and ecosystem health. The current objective of this work assignment will be to: 1) Aid in the development of protocols for the characterization of ENMs in complex media, 2) Aid in developing protocols for evaluating the release of ENMs under environmental conditions, 3) Identify relationships between physicochemical properties and the fate and exposure of ENMs.

Technical Approach:
The primary objective of this work assignment is to provide technical services to EPA ORD LRPCD.

The contractor shall conduct research to include:
Analytical analysis of experimental samples generated in the lab (based on the following research objectives). Analyses shall include but are not limited to:

- Solute anion analysis
- Solute TOC and IC analysis
- Solute digestion and subsequent metals analysis by appropriate analytical technique e.g. ICP-AES, AA (flame, graphite furnace, cold vapor, hydride generation)
- Solids digestion and subsequent metal analysis by appropriate analytical technique e.g. ICP-AES, AA (flame, graphite furnace, cold vapor, hydride generation)
- Scanning and Transmission electron Microscopy (SEM and TEM)
- Specific Surface Area Analysis
- X-ray Diffraction (XRD)
- X-ray Photoelectron Spectroscopy (XPS)
- Fourier Transformed Infrared Spectroscopy (FTIR)
- pH measurement
- Thermogravimetric analysis (TGA)
- Dynamic Light Scattering (DLS)
- Differential Scanning Calorimetry (DSC)
- UV/Vis Spectroscopy (UV/Vis)
- Wide Range Particle Spectrometer
- Microbial CLPP and FAME analysis
- DNA isolation and 454-pyrosequncing
- Characterizing of as purchased commercial products containing nanomaterials, utilizing the analytical methods outlined under analytical analysis
- Leaching experiments to determine the quantity and species of metals released from consumer products
- Development of analytical procedures for collecting particulate material from the leaching experiments to determine the presence of and speciation discrete inorganic particles present in the filtrate solutions.
- Soil incubation studies with nanomaterials released from consumer products.
- Synthetic dermal exposure studies utilizing the Rub Method developed by the Consumer Product Safety Commission

The contractor shall assist EPA ORD NRMRL with tasks listed below:

Task 1: Conduct solid and solution phase digestions and subsequent elemental analysis

1. The contractor shall conduct solution and solid phase digests of soils and sediments following standard EPA methods or LRPCD SOPs as appropriate. Following digestion the contractor shall determine elemental abundance in the samples using the appropriate analytical technique and following standard EPA methods or LRPCD SOPs as appropriate.

Task 2: Conduct research to examine the mobility and leachability of nano surface coatings (cerium oxide and zinc oxide) applied to wood substrates including micronized copper pressure treated lumber and lumber products.

1. The contractor shall: 1) work with the WACOR to develop a QAPP and HASP for the project (the HASP and QAPP shall be reviewed and updated quarterly). The contractor shall prepare the QAPP to reflect current LRPCD format, testing methods, controls, sampling locations, and other test chemicals. LRPCD QAPP templates in the current QAPP format will be provided by the WACOR or the LRPCD QA manager. It should be noted that QAPP revisions are not accepted until the LRPCD QA review and approval process is complete.

2. The contractor shall conduct a two part market survey. The first part shall identify products currently on the market that employ either zinc oxide or cerium oxide as an ingredient. Special attention shall be paid to products that utilize either material as a UV adsorber, specifically for protection of materials from UV degradation. The final product will provide a detailed list of the materials containing cerium oxide or cerium oxide, the recommended product use, ENM concentration, physical and chemical properties. The second portion of the market survey shall be to identify the most commonly used product for coating (staining, painting, protecting) wood, plastic (vinyl), synthetic wood, and aluminum surfaces. The final product shall be used to select appropriate products for adding ENMs prior to their application. The final product produced shall include a report detailing the results of the market research.

3. The contractor shall fully characterize the engineered nanomaterial surface coating materials and suspensions (herein referred to as ENMs) that have been obtained by the EPA thus far. Characterization of materials will occur as received from the manufacturer, and in matrix before and after application and/or use. Characterization will include both chemical and physical characterization of the materials. Chemical characterization will entail: inorganic chemical composition and identification of trace elements; composition, concentration, and identification of organic surface coatings and surfactants present in the ENMs, surface reactivity as determined by proton titration curves and zeta potential measurements across a wide pH range at multiple ionic strengths, surface analysis of the oxidation states and speciation of ENMs, and dissolution properties as a function of pH and matrix solution. Physical characterization of the materials will include: particle size and shape as determined by both SEM and TEM microscopies, hydrodynamic diameter by Dynamic Light Scattering as a function of pH and matrix solution, Particle surface area and porosity by nitrogen adsorption isotherm, and thermo gravimetric and differential calorimetry analysis. The final product for the task will be a synthesis report of the results for each of the materials characterized as pristine, in matrix, as applied, and after exposure.

4. Various methods may be used to apply nano surface coating to different substrates. Potential methods include brush or aerosol application. During aerosol application there is a potential for overspray and production of an ENM aerosol. Characterization of the over spray aerosol is critical for understanding the potential exposure and risk to humans. In order to assess the potential exposure the contractor shall conduct measurements to characterize the physical and chemical properties of the aerosol application ENM. Specific properties of interest include particle size, volume and

number; time series analysis of agglomeration, and potential changes in the ENM speciation. Experiments shall be conducted in a variety of matrices with different application methods. The final product of the subtask will be a draft manuscript of the research project for submission to a peer reviewed journal.

5. After application of the surface coating to a specific matrix the potential for release from either leaching or physical contact with the surface. In order to assess the potential release it is important to identify specific methods that are most appropriate given the potential use, application, and exposure routes. The contractor shall identify specific leaching solutions that would be appropriate for estimating environmental release of ENMs in surface coatings. The contractor shall identify appropriate methodologies for assessing leaching taking into account existing ASTM and standard methods used by the coating industry. For physical dislodgement assessments the contractor will utilize the wipe method developed by the US Consumer Product Safety Commission.

6. Extended exposure of the ENM surface coatings to environmental conditions (fluctuations in temperature, rainfall, UV exposure) may alter their initial release behavior. Therefore it is imperative to assess release throughout the product lifecycle. The contractor shall utilize the methods and assays identified previously to re-evaluate the release of ENMs after exposure to the environment. Changes in speciation and concentration of ENMs throughout the environmental will provide insight on how materials are transformed and their ultimate fate may be.

7. The final product delivered will be a journal manuscript which will cover the characterization of cerium oxide and zinc oxide aerosols produced during spray application of surface coating onto surfaces. This manuscript will lead into two other manuscripts in the future (not under the scope of this work assignment): one manuscript will cover the characterization of cerium oxide ENM and its release, fate and transformation from consumer products in the environment; and the second manuscript will cover the characterization of zinc oxide ENM and its release, fate and transformation from consumer products in the environment.

Task 3: Participate in the development and update of an Organization for Economic Co-Operation Development (OECD) method for estimating the removal of nanomaterials from waste due to association with sludge

1. The contractor shall: 1) work with the WACOR to develop a QAPP and HASP for the project (the HASP and QAPP shall be reviewed and updated quarterly). The contractor shall prepare the QAPP to reflect current LRPCD format, testing methods, controls, sampling locations, and other test chemicals. LRPCD QAPP templates in the current QAPP format will be provided by the WACOR or the LRPCD QA manager. It should be noted that QAPP revisions are not accepted until the LRPCD QA review and approval process is complete. 2) identify and secure use of analytical equipment and procedures required for analysis of samples collected, 3) obtain ENMs for testing from appropriate sources, and 4) perform laboratory bench scale work following the methods outlined in the Draft Test Guidelines and analyze all samples generated including additional ENM characterization efforts. The contractor shall document the experimental results and prepare tables and figures as necessary for data review and analysis by the WAM.

Deliverables

Deliverables	Date of Completion
Task 1 (no specific deliverable)	No specific delivery date
Task 2	September 28, 2016
Task 2-1	2 months after the start of the WA
Task 2-2	4 months after the start of the WA
Task 2-3	Characterization to occur throughout project
Task 2-4	August 1, 2016
Task 2-5	September 28, 2016
Task 2-5	September 28, 2016
Task 2-6	September 28, 2016
Task 2-7	September 28, 2016
Task 3	3 months after PoP start date

Reporting

In addition to monthly reports, the contractor shall:

- Supply the raw and as processed data in a spreadsheet format.
- In preparation for the manuscript in Tack 7 the contractor shall:
- Provide a detailed document on the materials and methods used. The document shall include two major sections Materials and Methods.
- Provide a detailed document on the results from each Task. The document should be broken out by each task. Figures and Table for the results will be provided.

Technical Qualifications

- The contractor shall supply personnel with previous laboratory experience conducting the experimentation and analytical procedures outlined in the Tasks and Research Objective section.
- The contractor shall provide personnel capable of managing the project on a day to day basis, as well as preparing information for the task reports and final report. Personnel should have previous laboratory experience in EPA laboratory activities and should be familiar with EPA rules and regulations for laboratory safety, including the required training.

Quality Assurance

- All research activities which generate data must follow the guidance of ORD policy and procedures manual section 13.4, *Minimum QA\QC Practices for ORD Laboratories Conducting Research*: PPM 13.4 Training.
- Research records shall follow the applicable policy for laboratory notebooks, according to ORD policy and procedure manual section 13.2, *Paper Laboratory Records*: PPM 13.2

Training.

- Copies of the current Quality Assurance policies may obtained here: Chapter 13 Policy and Procedures Manual.
- When applicable, the contractor shall follow SOPs published by LRPCD at http://intranet.ord.epa.gov/p2/nrmrl/standard-operating-procedures-technical-lrpcd. As SOPs are revised and new SOPs are published, the list of approved SOPs changes, therefore it is important that SOPs published at this web location be consulted when referencing LRPCD SOPs.
- The tasks in this work assignment identify QAPPs which will require revision. QAPP revisions must be reviewed and approved by the LRPCD QA manager before research begins under this contract action.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-82

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	To	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X	Option Period Number	Microbial and molecular analys

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	4 F

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

Period of Performance: From 11/13/2015 To 09/29/2016

Comments:
The contractor shall immediately start work on all tasks listed in the Work Assignment Performance Work Statement.

☐ 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 (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: To — 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 Mallikarjuna Nadagouda	(Signature)	(Date)	Branch/Mail Code:
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			FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7196
			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
EPA Contract No.: EP-C-15-010
Work Assignment: 0-82

TITLE: Microbial and molecular analyses of wastewater samples

WORK ASSIGNMENT MANAGER:

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ALTERNATE WORK ASSIGNMENT MANAGER

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PERIOD OF PERFORMANCE: Issuance-September 29, 2016

BACKGROUND:

The USEPA-ORD-NRMRL-Water Supply Water Resources Division will be conducting studies on the Microbial and molecular analyses of wastewater samples implicated in nitrification, deammonification and resource recovery from wastewater.

TASKS:

This shall be a new work assignment (WA) 0-82. For the task below, the contractor shall provide all materials or consumables involved for the experiments.

Microbial and molecular analyses of wastewater samples implicated in nitrification, deammonification and resource recovery from wastewater.

The contractor shall provide assistance in the purification and concentration of nucleic acid (both RNA and DNA) from wastewater samples. The task involves technical services leading to the description of microbial communities and detection of populations linked to nitrification, deammonification, bioenergy generation, and resource recovery from wastewater samples. Some of the samples will be collected by treatment plants' personnel. Additional samples from bioreactors/enrichments selecting for the aforementioned microbial processes will be collected by the contractors. The molecular methods to be used in this task include, but are not limited to, the use of Polymerase Chain Reaction (PCR) and quantitative PCR (qPCR), reverse-transcriptase qPCR (RT-qPCR), and next generation DNA sequencing of different phylogenetic and function-specific genetic markers. The contractor shall follow standard operating procedures for the nucleic acid extraction and downstream analyses as provided by the principal investigator. Additionally, contractor shall organize the data in spreadsheets and provide

relevant document files, laboratory notebooks, and all raw data at different intervals of the work assignment. The contractor will run/process 500 samples.

Description of Services:
The contractor and the Work Assignment Manager shall have weekly meetings in person or via conference call to discuss results and experimental design, during the entire work assignment period of performance.

Work will be performed in the MCCB microbiology laboratories located within the AWBERC building. Any work involving external field sites(Local) will be identified by the EPA WAM via written Technical Direction.
The contractor shall perform work under an EPA approved QAPP. The contractor shall assist in preparation of the Health and Safety Plan and Quality Assurance Project Plan, and assist with any needed modifications to either the Quality Assurance Project Plan or the Health and Safety Plan.

The contractor shall record all of his/her work in a bound laboratory notebook which shall be provided for this work assignment. All electronic records will reside on the EPA LAN network and all file names and file locations on the LAN will be described in the project laboratory notebook. Weekly updates with the WAM will occur to discuss the data recorded in the notebook from the previous week. There shall be monthly meetings to discuss the data that has been generated with the WAM. These discussions shall cover the data analysis and any laboratory procedural issues.
The contractor shall work with WAM in drafting one or two possible manuscripts for submissions to peer review journals.

DELIVERABLES:

Quality Assurance Project Plan (QAPP):
The Category 3 Quality Assurance Project Plan (QAPP) shall be written and submitted for EPA WAM review by the contractor for the research within 30 days of the start of the work assignment period of performance. The contractor shall not initiate any research tasks until the EPA has approved any QAPP/addenda. The contractor shall revise any QAPP and/or Safety/Health plans per written technical direction from the EPA WAM. The contractor shall identify the change and explain the rationale for the change. The EPA WAM, in concert with the contractor, is responsible for ensuring that the QAPP is kept current. Any revisions to an approved QAPP must be submitted to the EPA WAM and the EPA QA manager for review. Implementation of the revision(s) commence(s) only after the contractor receives written EPA approval.

Health and Safety Project Plan:
The contractor shall prepare and submit for review/approval a Health and Safety Project Plan (HASP). The HASP shall cover the contractor's staff as well as any subcontractor staff. The contractor shall address HASP protocols and procedures at the initial project kick-off meeting to discuss work assignment objectives.

Final Report:
The contractor shall prepare and submit a final report within September 29, 2016.

Monthly Meetings:
Project meetings shall be conducted once per month or as often as needed by the WAM to assure the completion of the research efforts. These project meetings may be changed by mutual agreement. The contractor shall provide

briefings on the monthly progress reports including:

a. Status and progress of the research

b. Planned activities for the upcoming period

c. Problems encountered and resolutions

d. Budget Information

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-88

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	To	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X	Option Period Number	Lab Support Cyanobacteria

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	4.A.3, 4.C.3, 4.D.3, 4.E.1, 4.E.2, 4.E.3

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

Period of Performance: From 10/09/2015 To 09/29/2016

Comments:
The contractor shall immediately start work on all tasks listed in the Work Assignment Performance Work Statement.

☐ 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 (Max 7)
1										
2										
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4										
5										

Authorized Work Assignment Ceiling

Contract Period: To — 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 Nicholas Dugan	(Signature)	(Date)	Branch/Mail Code:
			Phone Number 513-569-7239
			FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7196
			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
Contract EP-C-15-010
Work Assignment# 0-88

TITLE: Laboratory Support for Cyanobacteria and Toxins

WORK ASSIGNMENT CONTRACTING OFFICER'S REPRESENTATIVE:
Nicholas Dugan, 513-569-7239

ALT WACOR: Darren Lytle, 513-569-7432

PERIOD OF PERFORMANCE: CO Issuance – September 29, 2016

RELEVANT SECTIONS IN CONTRACT SCOPE OF WORK:
4(A)(1), 4(C)(3), 4(D)(3), 4(E)(1), 4(E)(2), 4(E)(3)

LEVEL OF EFFORT (DIRECT LABORATORY LABOR): 1640 hours

I. BACKGROUND

Over the past decade, surface waters in the United States have been experiencing cyanobacterial blooms of progressively increasing severity. These cyanobacteria produce a range of toxins that have been shown to be harmful to human health. Of these toxins, three are currently included on the third version of the EPA's Contaminant Candidate List (CCL3): anatoxin-a, microcystin-LR, and cylindrospermopsin. The EPA is also considering asking drinking water utilities to begin monitoring for these toxins under the Unregulated Contaminant Monitoring Rule (UCMR).

As part of the EPA's effort to assess the degree of human exposure to these toxins, as well as the treatability of the toxins, the Treatment Technology Evaluation Branch of the Water Supply and Water Resources Division (WSWRD/TTEB) has initiated (1) a field studies to evaluate toxin propagation through drinking water treatment facilities, and (2) a bench-scale studies to evaluate drinking water treatment options, and (3) analytical support activities to assist local, state, and federal agencies in their cyanobacteria management efforts.

II. OBJECTIVES

(1) Field studies to evaluate toxin propagation through drinking water treatment facilities
(2) Bench-scale studies to evaluate drinking water treatment options
(3) Analytical support activities to assist local, state, and federal agencies in their cyanobacteria management efforts.

III. APPROACH

In support of these objectives, the contractor shall supply a laboratory worker(s) who shall execute following tasks:

Task 1 – Analyze samples collected from drinking water treatment facilities and surface waters in support of Objectives (1), (2) and (3)

(1) Analysis of samples for chlorophyll-a and other light harvesting pigments.
(2) Analysis of samples for cyanobacterial toxins and toxicity by enzyme linked immune substrate assay (ELISA). NOTE: Analysis of samples is expected to consume 65 ELISA kits.
(3) Analysis of samples for cyanobacterial biomass by microscopy and flow cytometry
(4) Perform literature searches as needed.

Task 2 – Execute a series of bench-scale tests to assess the impacts of potassium permanganate, PAC addition, chlorine addition, coagulant addition, copper sulfate addition and floc enmeshment on intact cyanobacterial cells.

In support of these jar tests, the contractor shall perform the following after receipt of written technical direction from the WACOR:

1. Preparation for tests.
2. Execution of tests
3. Analyses of samples from tests
4. Reduction and analysis of data from tests

The WACOR shall provide written SOPs for the execution of all tasks described above. In the course of executing the tasks described above, the contractor shall fill out log books in a manner specified by the WACOR. Log books shall record date, time, studies conducted, observations, cross references to data sheets and sample labels, etc. Log books shall also record all problems encountered.

Task 3 – Execute a series of bench-scale jar tests to assess the impact of floc enmeshment on the ability of chlorine to penetrate cyanobacterial cells:

In support of these jar tests, the contractor shall perform the following:

1. Preparation of aluminum sulfate, ferric chloride, and sodium hypochlorite stock solutions as needed.
2. Execution of jar tests using various combinations and concentrations of aluminum sulfate, ferric chloride, sodium hypochlorite, and cultured cyanobacterial cells.
3. Sampling from the jars in step 2, and analysis of the samples for chlorophyll-a according to EPA Method 445.0 (Task 1 – subpart 1).
4. Cleaning of glassware by Contrad soak, de-ionized water rinsing, and burning in a muffle furnace.

The WACOR shall provide written SOPs for the execution of all tasks described above. In the course of executing the tasks described above, the contractor shall fill out log books in a manner specified by the WACOR. Log books shall record date, time, studies conducted, observations,

cross references to data sheets and sample labels, etc. Log books shall also record all problems encountered.

Task 4 – Maintain and propagate cyanobacteria in culture

In support of these jar tests, the contractor shall perform the following:

1. Preparing culture solutions.
2. Transferring cells.
3. Performing literature searches as needed.

The WACOR shall provide written SOPs for the execution of all tasks described above. In the course of executing the tasks described above, the contractor shall fill out log books in a manner specified by the WACOR. Log books shall record date, time, studies conducted, observations, cross references to data sheets and sample labels, etc. Log books shall also record all problems encountered.

IV. PROGRESS REPORTING AND MEETINGS

The contractor shall schedule work assignment meetings approximately monthly or as requested by the WACOR to assure the completion of the research efforts. The contractor shall provide at a minimum the following;

- $ Planned activities for the upcoming period
- $ Up-to-date data logs and charts at each meeting.
- $ Status and progress of the research
- $ Problems encountered and resolutions
- $ Budget information,

The contractor shall provide to the EPA WACOR all project management information in hard copy and electronic format. The contractor shall summarize project meetings and submit to the EPA-WAM and the Contract Level COR in an agreed upon format.

V. QUALITY ASSURANCE

All work described above shall be conducted in adherence with the QA/QC requirements set forth in **QA W-00040-QP-1-0: Cyanobacteria and Toxin Sampling, Analysis and Treatment at Bench-, Pilot- and Full-Scales.** The WACOR shall supply a copy of the QAPP to the contractor.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-89

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	To	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X	Option Period Number	Material Research for Environm

Contractor: PEGASUS TECHNICAL SERVICES, INC.

Specify Section and paragraph of Contract SOW: Section 4 (A)(2), Section 4 (A)(3).

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

Period of Performance: From 09/30/2015 To 09/29/2016

Comments:
The contractor shall immediately start work on all tasks listed in the Work Assignment Performance Work Statement.

☐ 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 (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: To — 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 Anthony Zimmer	(Signature)	(Date)	Branch/Mail Code:
			Phone Number 513-487-2426
			FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7196
			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

CONTRACT NO. EP-C-15-010

WORK ASSIGNMENT 0-89

LABORATORY AND ANALYTICAL SUPPORT MATERIAL RESEARCH FOR ENVIRONMENTAL APPLICATIONS

WORK ASSIGNMENT CONTRACTING OFFICER'S REPRESENTATIVE:
ANTHONY ZIMMER
513-487-2426
ZIMMER.ANTHONY@EPA.GOV

ALTERNATE WACOR: SOUHAIL AL-ABED
513-569-7196
AL-ABED.SOUHAIL@EPA.GOV

PERIOD OF PERFORMANCE: Oct. 1, 2015 through Sept. 30, 2016

LOCATION: On-site

1. Review Project Background:

Understanding the synthesis, fate and transport of materials is an essential aspect of protecting human health and the environment. Obtaining bulk materials directly from industry and testing its behavior is an integral aspect of environmental research. However, understanding how these materials are manufactured is equally important area of research in determining its environmental (e.g., waste generated during the material processing) or health (e.g., surface properties of the nanoparticle that inadvertently increased its toxicity) impacts.

Aerosol processes generate the vast bulk of commercial engineered "particles" used on a daily basis. As examples, aerosol generated particles are found in transportation (carbon black used in tires), buildings (micronized copper in pressure-treated lumber), and pharmaceutical and personal care products (fumed silica in drug tablets to titanium dioxide in toothpaste). From a materials engineering standpoint, aerosol processes offer several distinct advantages over wet chemistry processes including: (1) no liquid by-products, (2) easier and cheaper particle collection, (3) fewer process steps, and (4) vigorous transport phenomena leading to materials with high purity (Buesser and Pratsinis, 2012).

Unfortunately, on-going EPA materials research has focused upon creating engineered materials using *solution-based synthesis techniques*, a small subset of the industrial/commercial engineered materials in use today. Aerosol generation of

materials, using cost effective techniques such as electrosprays, plasmas and furnaces, is a fundamentally different methodology. This research has several objectives including:

- Providing fundamental process tree inputs for life cycle assessments, especially given that commercial nanotechnology synthesis processes are closely guarded trade secrets
- Providing a matrix potentially more cost-effective and fundamentally different from solution-based synthesis of engineered nanoparticles for risk management solutions
- Providing an alternative means of producing highly controllable materials (e.g., silver nanoparticles from aerosols) to compare/contrast their fate and transport through soil/sediments and their chemical and physical properties.
- Produce particles/coatings for application to a broad range of environmental benign applications

The initial focus of this research will be in two areas: (1) creating an engineered oil simulant using aerosol processes, and (2) creating a nano-scale, iron based remediation material using aerosol processes.

2. Update Health and Safety Plan (HASP)

The contactor shall use and if needed amend the Material Research for Environmental Applications Project Health and Safety Plan.

3. Update and Follow the Quality Assurance Project Plan (QAPP)

The contactor shall use and if needed amend the Material Research for Environmental Applications Project QAPP (Level III). Additional information on how to develop QAPPs can be found in the following web resources: http://www.epa.gov/quality/ http://www.epa.gov/quality/qa_docs.html Specific guidance on developing Quality Assurance Project Plans can be found at http://www.epa.gov/quality/qapps.html

All research activities which generate data must follow the guidance of ORD policy and procedures manual section 13.4, *Minimum QA\QC Practices for ORD Laboratories Conducting Research*: PPM 13.4 Training. Research records shall follow the applicable policy for laboratory notebooks, according to ORD policy and procedure manual section 13.2, *Paper Laboratory Records*: PPM 13.2 Training. Copies of the current Quality Assurance policies may obtained here: Chapter 13 Policy and Procedures Manual.

When applicable, the contractor shall follow SOPs published by LRPCD at http://intranet.ord.epa.gov/p2/nrmrl/standard-operating-procedures-technical-lrpcd. As SOPs are revised and new SOPs are published, the list of approved SOPs changes, therefore it is important that SOPs published at this web location be consulted when referencing LRPCD SOPs. The tasks and subtasks in this contract action identify QAPPs which will or may require revision. QAPP revisions must be reviewed and approved by the LRPCD QA manager before research begins under this work assignment.

4. Work / Experimental Requirements:

The contractor shall complete the following tasks:

(a) Prepare a detailed literature review pertinent to applicable aerosol synthesis processes.
(b) Purchase laboratory supplies (e.g., stainless and conductive tubing, associated connective fittings) to support material synthesis research
(c) Develop SOP for the material synthesis equipment (e.g., plasma, electrosprays, nebulizer, furnaces) and measurement devices (e.g., Wide-range Particle Spectrometer)
(d) Develop experimental plan to evaluate methods and approaches for data collection to optimize data quality and minimize experimental error
(e) Perform synthesis and characterization studies on engineered materials to determine their properties (e.g., particle size, particle size distribution)
(f) Perform synthesis and characterization studies on engineered materials to determine their hydrosol properties (e.g., particle size, particle size distribution)
(g) Perform characterization studies on engineered materials to determine their morphological and physical properties (e.g., techniques such as FE-SEM, HR-TEM, Zeta potential, XRD, DSC, TGA, BET, and AFM)
(h) Perform characterization studies on engineered materials to determine their chemical properties (e.g., techniques such as UV/VIS, GCMS, XAS, XPS, XRF, FTIR, NMR, Excitation-Emission Matrix Spectroscopy)

5. Progress Meetings:

Weekly progress meetings shall be held with the EPA WACOR. Technical direction and alternations to the experiments from the WACOR will be discussed during the weekly progress meetings. If an alternation to an experiment is too significant, a work assignment amendment will be issued.

6. Expected Outputs:

(a) The contractor shall provide the data from the experiments in spreadsheets format (EXCEL) including QA parameters and the analytical procedures followed by the contractor in Word. Provide laboratory notebooks formatted according to SOP # 16 (to be provided separately by the WAM) (Table 1).
(b) The contractor shall provide three to five drafts manuscripts for publication in peer-reviewed journals engineered materials research.
(c) Attend and present posters and talks at national/international meetings as requested by the EPA WACOR through written technical direction. All travel must be approved by the Project Officer in accordance with the contract clause. EPA expects 1 to 2 of these events, locations are not yet known.

National meetings shall not exceed 4 days. International meetings shall not exceed 10 days. The contactor shall present findings from the research identified in this WA in forms of presentations, seminars, and posters. They may also co-organize symposiums during the conference and participate in panel discussions.

Table 1. Experimental research milestones

Milestone	Delivery Date (months after issuance)
Amend draft HASPs and QAPPs	End of Month 1
Task b, procure supplies and equipment	End of Month 1
Task a, literature review	End of month 2
Task c, develop equipment SOPs	End of month 2
Task d, experimental design	End of month 3
Task e and f, experiments status report	End of each month (4-10)
Task g and h, experiments status report	End of each month (4-10)
Final sample processing and data analysis, interpretation of experimental data and submission of draft final report.	End of Month 11
Delivery of final report	September 29, 2016

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-92

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	To	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X	Option Period Number	SOP Revisions Support for LRPC

Contractor: PEGASUS TECHNICAL SERVICES, INC.

Specify Section and paragraph of Contract SOW: Section F(1, 3, 4)

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

Period of Performance: From 10/23/2015 To 09/29/2016

Comments:

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

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

SFO (Max 2) ☐

Line	DCN (Max 6)	Budget/FY (Max 4)	Appropriation Code (Max 6)	Budget Org/Code (Max 7)	Program Element (Max 9)	Object Class (Max 4)	Amount (Dollars)	(Cents)	Site/Project (Max 8)	Cost Org/Code (Max 7)
1										
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Authorized Work Assignment Ceiling

Contract Period: To — Cost/Fee: — LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: — Cost/Fee: — LOE:

Cumulative Approved: — Cost/Fee: — LOE:

Work Assignment Manager Name Jim Voit	(Signature)	(Date)	Branch/Mail Code:
			Phone Number 513-487-2867
			FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7196
			FAX Number:
Other Agency Official Name Jim Voit	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-487-2867
			FAX Number:
Contracting Official Name Candice Charlton	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-487-2007
			FAX Number:

Performance Work Statement
EPA Contract No.: EP-C-15-010
Work Assignment: 0-92

1. **Title:** Revision of LRPCD SOP Documentation

2. **Work Assignment Contracting Officer's Representative:**

   Name: Jim Voit
   Address: 26 West MLK Dr., Cincinnati, OH 45268
   Phone: 513-487-2867
   email: voit.jim@epa.gov

   Alternate Work Assignment Contracting Officer's Representative:
   Name: Lauren Drees
   Address: 26 West MLK Dr., Cincinnati, OH 45268
   Phone: 513-569-7087
   email: drees.lauren@epa.gov

3. **Period of Performance:** Date issued to September 29, 2016

4. **Overview:** LRPCD produces and maintains Standard Operating Procedures (SOP) documentation for laboratory and quality assurance procedures which are specific to activities in this division of NRMRL. In accordance with the requirements of the NRMRL Quality Management Plan (QMP), this documentation is reviewed and if necessary revised on a bi-annual basis.

   A total of 2 SOPs will need revision over the PoP, due to the QMP biannual review requirement. Additionally, 12 new SOPs will be required for new and existing LRPCD instrumentation and laboratory procedures.

5. **Technical Approach**

   a. Task 1: The contractor shall reformat existing SOPs into the NRMRL SOP format.
      i. A NRMRL document template in MS Word has been created and approved by the NRMRL IO for that purpose. This template will be provided by the WACOR for use in formatting LRPCD SOPs.
      ii. The contractor shall reformat the SOPs using the text from the existing SOPs.
      iii. The SOPs in their current format are maintained by the WACOR, who is the LRPCD Quality Assurance Manager (QAM). Copies of the SOPs to be revised will be provided by the WACOR to the contractor.
   b. Task 2: The contractor shall review existing SOPs on a technical basis for consistency with the current practice in LRPCD laboratories, and if necessary revise an SOP to accurately define the procedures as currently operated in the LRPCD laboratory.
      i. Specifically, the contractor shall identify technical staff members with experience and proficiency in the SOP to be reviewed. That individual shall provide comments on the SOP relative to the current implementation of the SOP in the LRPCD laboratory.

ii. If it is determined that there has been no significant change in the procedures as described in the current revision of the SOP, this will be so indicated on the revision.

iii. If it is determined that the SOP is consistent with current LRPCD laboratory practices, but has technical deficiencies such that data quality and or productivity may be improved by a revision to the SOP, this observation shall be communicated to the WACOR with a brief description of the noted deficiency(s) and proposed modifications. The WACOR will review the proposed changes and direct the contractor as follows:

1. Proceed with the revision and incorporate the proposed changes.
2. Make no change to the SOP, other than to the document format.
3. Make other changes as determined from technical review and input from LRPCD research staff.

iv. The contractor must document changes to existing SOPs using the format provided in the NRMRL SOP template.

c. Task 3: New LRPCD SOPs: New SOPs are required for procedures which are routinely operated in the LRPCD. Where there are existing versions of these SOPs in draft or other format, the text will be provided to the contractor by the WACOR as a starting point.

i. The contractor shall reformat the existing text using the approved NRMRL SOP template, then the document shall be reviewed for technical accuracy by contractor staff with experience and proficiency in the SOP to be produced.

ii. If it is determined that technical revisions are needed to accurately define the procedure, such changes may be made without WACOR involvement as required in 5.b.iii, above.

6. Deliverables:

a. Approved Revised SOP: minimum one (1) SOP in each month of the performance period until all SOP revisions have been addressed.

b. Approved new SOP: ten (10) SOPs, by the end of the PoP.

c. Deliverables must conform to the format of the NRMRL template. The final documents must be fully proofed for spelling, grammar, and punctuation using the MS Word functions. A final proof of the document is required to catch errors not corrected by the MS Word functions (such as correct spelling but incorrect usage: for example, from/form). The deliverable shall be delivered as an MS Word document file (.docx), with a "draft" watermark to clearly indicate that the deliverable is a work product in process.

d. Deliverables will be reviewed by the WACOR for technical content, conformance to NRMRL quality assurance and quality control requirements, and for conformance to the NRMRL SOP format.

e. SOPs must be 508 compliant. Guidance on the requirements for compliance will be provided on the sharepoint site established for document management for this work assignment, and from the work assignment manager.

f. Comments on the deliverable which does not meet format and content requirements will be provided to the contractor within 10 working days

after receipt of a draft deliverable. Comments will be provided in the draft document using MS Word review comments, and will indicate specifically by document section number what deficiencies need further revision.

g. The WACOR will acknowledge acceptance of a draft deliverable which meets format and content requirements within 10 working days after receipt of a draft deliverable.

7. **Reporting**
   a. **Monthly Reports:** Monthly reports summarizing the status of the WA shall be completed and provided as specified under Contract EP-C-15-010 requirements.
   b. **Project Meetings:** None anticipated, but may be scheduled as needed to clarify technical content and format revisions.
8. **Technical Qualifications:** Technical proficiency in the procedure, or standard method from which the procedure is derived, is required for the technical reviewer to propose modifications to existing SOPs. Similarly, a technically proficient reviewer is required to make document additions or modifications for a new SOP.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-93

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	To	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X	Option Period Number	Reservoir gas emissions

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	Section 4, paragraph B, sub paragraph 4.

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

Period of Performance: From 09/30/2015 To 09/29/2016

Comments:
The contractor shall immediately start work on all tasks listed in the Work Assignment Performance Work Statement.

☐ 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 (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: To — 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 Jake Beaulieu	(Signature)	(Date)	Branch/Mail Code:
			Phone Number 513-569-7842
			FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7196
			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:

Contract No. EP-C-15-010
Work Assignment 0-93

Title: Monitoring gas emissions from reservoirs

Work Assignment Manager:
Jake Beaulieu, beaulieu.jake@epa.gov, 513-569-7842

Alternate Work Assignment Manager:
Michelle Simon, simon.michelle@epa.gov, 513-569-7469

Project Officer: Michael Moeykens

Period of Performance: 09/30/2015 through 09/29/2016

Site: US EPA AWBERC Facility, reservoirs in Ohio

Quality Assurance Project Plan: Use QAPP W-21151 developed by the EPA WAM. No QAPP shall be modified/developed under this WA.

Project Background
The Water Supply and Water Resources Division (WSWRD; Drs. Jake Beaulieu and Michelle Simon) of the U.S. Environmental Protection Agency have initiated an investigation of greenhouse gas emissions (e.g. methane and nitrous oxide) from reservoirs operated by the US Army Corp of Engineers (US ACE). It is estimated that reservoirs may be the source of up to 20% of global anthropogenic methane (CH_4) emissions, but estimates are highly uncertain, partly due to a lack of ebullition measurements. Ebullition occurs when gas bubbles are released from the sediment, rise through the water column, and enter the atmosphere. Ebullition is highly variable across space and time and is therefore difficult to quantify; however, this emission pathway can be the source of >90% of total annual emissions.

We plan to quantify methane ebullition in two US ACE reservoirs in Ohio from May 2015 thru December 2016 using automated inverted funnels. The device consists of a submerged cone connected to a transparent PVC pipe that serves as a collection chamber. As bubbles rise through the water column they are intercepted the cone and funneled into the collection chamber. A differential pressure sensor at the top of the pipe measures the pressure caused by gas accumulation in the chamber. These devices provide estimates of ebullition rates at 5-10 minute intervals for up to 6 months.

An important component of this study is relating methane ebullition to water-level management. Bubble formation in sediments is highly sensitive to changes in hydrostatic pressure at the sediment-water interface, which occurs when water levels are lowered to facilitate dam inspections, support whitewater kayaking, or to increase water storage capacity for impending storms. We hypothesize that these abrupt changes in water levels may trigger short-term increases in ebullition.

Health and Safety Plan (HASP)
Use plan developed by EPA WAM.

Work / Experimental Requirements
The contractor must have a minimum of a Bachelor's degree plus two years of experience working in the environmental sciences field. The contractor must have experience leading crews for at least two projects that included a mix of lab and field work. These experiences must include the independent implementation of a QAPP provided by an EPA WAM. The contractor must have a minimum of one year experience calibrating, programming, deploying, retrieving, and downloading data from sondes. In addition, the contractor must have experience with all aspects of using (i.e. calibrating, programming, deploying, retrieving, data management) at least three different types of electronic environmental sensors or samplers (i.e., barometer, light meter, sondes, pressure transducers, ISCO samplers). The Contractor will always be accompanied by the Government on field sampling trips, but will be responsible for making informed decisions when the EPA WAM is not present.

The contractor shall execute the tasks detailed in QAPP W-21152. Briefly, the tasks detailed in the QAPP are as follows:

Task 1:
The contractor shall operate a boat as necessary to execute the tasks described in the QAPP. The contractor shall obtain all training required by the US EPA and Ohio Department of Natural Resources for operating a boat. Per EPA policy, First Aid / CPR certification now required for boat operators.

Task 2:
The contractor shall assist in the deployment and maintenance of 10 ebullition gas traps at Harsha Lake, located near Cincinnati, Ohio. The gas traps must be maintained every week (requires two field days to service all traps) between the start of the WA Period of Performance and early December, 2015. Not to exceed18 site visits. Maintenance activities the contractor shall perform include measuring the volume of gas in the traps, collecting a sample of gas from the traps, and downloading data from the traps onto a laptop.

Task 3:
Within 24 hours of executing task 2, the contractor shall collect water samples and measure water temperature, pH, dissolved oxygen, and specific conductivity from a minimum of two depths at the location of each gas trap.

Task 4:
Within 24 hours of executing task 2, the contractor shall measure methane and carbon dioxide emission rates using floating chambers at the location of each gas trap.

Task 5:
Within 72 hours of executing Task 2, the contractor shall download all digital data (i.e., gas trap data, sonde data, GPS data, greenhouse gas analyzer data).

Task 6:
The contractor shall assist with the preparation of sampling equipment between site visits. This includes, but isn't limited to, acid washing water bottles and water sample collection devices, calibrating sondes, charging batteries, evacuating gas sample vials, and labeling sample collection vessels.

Expected Outputs
The Contractor shall deliver data from environmental sensors to the WAM.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-93

☐ Other ☒ Amendment Number: 000001

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-C-15-010	09/30/2015 To 09/29/2016 Base X Option Period Number	Regional CH4 Assesment

Contractor: PEGASUS TECHNICAL SERVICES, INC.

Specify Section and paragraph of Contract SOW: Section 4, Paragraph B

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

Period of Performance: From 09/30/2015 To 09/29/2016

Comments:
The purpose of this amendment is to add new ecosystem monitoring tasks to the PWS.

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

SFO (Max 2) ☐

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

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

Authorized Work Assignment Ceiling

Contract Period: 09/30/2015 To 09/29/2016 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Jake Beaulieu	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7842 FAX Number:
Project Officer Name Michael Moeykens	(Signature) (Date)	Branch/Mail Code: Phone Number: 513-569-7196 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:

Contract No. EP-C-15-010
Work Assignment 0-93 Amendment 1

Title: Monitoring gas emissions from reservoirs

Work Assignment Contracting Officer's Representative (WACOR):
Jake Beaulieu, beaulieu.jake@epa.gov, 513-569-7842

Alternate WACOR:
Michelle Simon, simon.michelle@epa.gov, 513-569-7469

Period of Performance: 09/30/2015 through 09/29/2016

Site: US EPA AWBERC Facility, reservoirs in Ohio, Indiana, and Kentucky

The purpose of this amendment is to add new tasks 7 - 9. Any new language is provided in red text.

Quality Assurance Project Plan: Use QAPP W-21151 and QAPP FOR A REGIONAL ASSESSMENT OF METHANE EMISSION RATES FROM RESERVOIRS developed by the EPA WACOR. No QAPP shall be modified/developed under this WA.

Project Background
The Water Supply and Water Resources Division (WSWRD; Drs. Jake Beaulieu and Michelle Simon) of the U.S. Environmental Protection Agency have initiated an investigation of greenhouse gas emissions (e.g. methane and nitrous oxide) from reservoirs operated by the US Army Corp of Engineers (US ACE). It is estimated that reservoirs may be the source of up to 20% of global anthropogenic methane (CH_4) emissions, but estimates are highly uncertain, partly due to a lack of measurements.

We plan to measure methane emissions in up to 32 reservoirs in Ohio, Indiana, and Kentucky. Each reservoir will be visited once between June 1 and September 30, 2016. Fifteen sites within each reservoir will be sampled for diffusive and ebullitive (i.e. bubbling) CH_4 emissions using floating chambers and inverted funnels, respectively.

Health and Safety Plan (HASP)
Use plan developed by EPA WACOR (HASP 2015-026).

Work / Experimental Requirements
The contractor must have a minimum of a Bachelor's degree plus two years of experience working in the environmental sciences field. The contractor must have experience leading crews for at least two projects that included a mix of lab and field work. These experiences must include the independent implementation of a QAPP provided by an EPA WAM. The contractor must have a minimum of one year experience calibrating, programming, deploying, retrieving, and downloading data from sondes. In addition, the

contractor must have experience with all aspects of using (i.e. calibrating, programming, deploying, retrieving, data management) at least three different types of electronic environmental sensors or samplers (i.e., barometer, light meter, sondes, pressure transducers, ISCO samplers). The Contractor will always be accompanied by the Government on field sampling trips, but will be responsible for making informed decisions when the EPA WAM is not present.

The contractor shall execute the tasks detailed in QAPP W-21152. The contractor will also execute all tasks described in QAPP A REGIONAL ASSESSMENT OF METHANE EMISSION RATES FROM RESERVOIRS, with the exception of maintaining the automated gas trap at Harsha Lake. Briefly, the tasks detailed in the QAPPs are as follows:

Task 1:
The contractor shall operate a boat as necessary to execute the tasks described in the QAPP. The contractor shall obtain all training required by the US EPA and Ohio Department of Natural Resources for operating a boat. Per EPA policy, First Aid / CPR certification now required for boat operators.

Task 2:
The contractor shall assist in the deployment and maintenance of 10 ebullition gas traps at Harsha Lake, located near Cincinnati, Ohio. The gas traps must be maintained every week (requires two field days to service all traps) between the start of the WA Period of Performance and early December, 2015. Not to exceed18 site visits. Maintenance activities the contractor shall perform include measuring the volume of gas in the traps, collecting a sample of gas from the traps, and downloading data from the traps onto a laptop.

Task 3:
Within 24 hours of executing task 2, the contractor shall collect water samples and measure water temperature, pH, dissolved oxygen, and specific conductivity from a minimum of two depths at the location of each gas trap.

Task 4:
Within 24 hours of executing task 2, the contractor shall measure methane and carbon dioxide emission rates using floating chambers at the location of each gas trap.

Task 5:
Within 72 hours of executing Task 2, the contractor shall download all digital data (i.e., gas trap data, sonde data, GPS data, greenhouse gas analyzer data).

Task 6:
The contractor shall assist with the preparation of sampling equipment between site visits. This includes, but isn't limited to, acid washing water bottles and water sample

collection devices, calibrating sondes, charging batteries, evacuating gas sample vials, and labeling sample collection vessels.

Task 7:
The contractor shall measure CH_4 ebullition and diffusion at 15 sites in up to a total of 32 reservoirs in Ohio, Indiana, and Kentucky. Ebullition samplers shall be deployed for a minimum of 12 hours at each site. Reservoirs will be located 40 – 300 miles from Cincinnati. Approximately 70% of the reservoirs will be located between 100 and 300 miles from Cincinnati. The remaining 30% will be located between within 100 miles from Cincinnati.

The Government will furnish an aluminum boat and trailer manufactured by Oquawka. The boat is 18' long, 5' wide at the stern, and has a V bough. The boat is equipped with a 90 hp Mercury engine. The boat will be in sole possession of the contractor when in use, including multiple overnight trips. The boat shall be returned to a government facility at the conclusion of each sampling trip.

Task 8:
The contractor will collect water, sediment, and gas samples from each of the reservoirs. Samples shall be returned to AWBERC for processing by the EPA.

Task 9:
Within 7 days of executing Task 7, the contractor shall download all digital data (i.e., sonde data, GPS data, greenhouse gas analyzer data).

Expected Outputs
The Contractor shall deliver all data from environmental sensors to the WACOR.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 0-96

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	To	Title of Work Assignment/SF Site Name
EP-C-15-010	Base X	Option Period Number	Green Engineering Mat. Manage.

Contractor	Specify Section and paragraph of Contract SOW
PEGASUS TECHNICAL SERVICES, INC.	H-3 ; H-5; H-7; H-10 ; H-11; H-12

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

Period of Performance: From 11/05/2015 To 09/29/2016

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 (Max 7)
1										
2										
3										
4										
5										

Authorized Work Assignment Ceiling

Contract Period: To — 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 George Moore	(Signature)	(Date)	Branch/Mail Code:
			Phone Number 513-569-7991
			FAX Number:
Project Officer Name Michael Moeykens	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7196
			FAX Number:
Other Agency Official Name Diana Redmond	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-569-7508
			FAX Number:
Contracting Official Name Candice Charlton	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 513-487-2007
			FAX Number:

PERFORMANCE WORK STATEMENT

GEMM, characterization of data, interpretation of data, and management of data.

CONTRACT NO. EP-C-15-010

WORK ASSIGNMENT NUMBER: 0-96

PERIOD OF PERFORMANCE: CO Issuance – September 29, 2016

WORK ASSIGNMENT CONTRACTING OFFICER'S REPRESENTATIVE (WACOR):
George Moore
513.569.7991
Moore.George@epa.gov

ALTERNATE WACOR: John Abraham
513-569-7124
Abraham.John@epa.gov

Location: On-Site or Off-Site

Background:

The Office of Research and Development (ORD) at US EPA has re-aligned its research activities into six new programs aimed at providing support to the Regions, Program Offices, States, Tribes, and communities who are charged with making decisions aimed at environmental sustainability. ORD created the Chemical Safety for Sustainability (CSS) Research Program to help ensure safety in the design, manufacture, and use of existing and future chemicals.

In addition, EPA's National Pollution Prevention (P2) Program and the Office of Chemical Substances and Pollution Prevention (OCSPP) are identifying opportunities to reuse certain hazardous secondary materials as a method of source reduction. The Green Engineering Materials Management (GEMM) analysis methodology is able to identify a subset of high-value secondary hazardous materials that can be readily recovered and managed as a chemical substance. This analysis is based on the remanufacturing exclusion proposed in the 2011 revisions to the Definition of Solid Waste rule.

This research's immediate focus is to highlight four solvents (methanol, toluene, acetonitrile, and dichloromethane) used in high volume by, among others, pharmaceutical manufacturers. Most of these solvents are destroyed after only one use and extending the life of these managed materials generates significant benefits and lowers the potential for human health risk. This project seeks to enable facility managers and regulators to manage these materials as products, offsetting virgin materials produced by other manufacturers, thereby contributing to the reduction of significant greenhouse gas (GHG) impacts as a result of production of the virgin materials, using

them only once, followed by their destruction.

Project Description with Software Simulation Goals for statistical testing and verification:

- Facilitate trial implementation via simulation in GEMM/LCA tool for the reuse of organic solvents used as reaction medium/agents in the pharmaceutical industry and others, as identified using the Green Engineering Materials Management (GEMM) approach.
- Test and deploy tools and training methods and materials to allow this approach to be transferred regionally and nationally, and to calculate GHG reductions from these new practices.

Purpose:

The purpose of this work assignment is to provide technical services to the EPA in conducting research, development, and evaluation studies.

Work Assignment Requirements:

The contractor shall furnish personnel and services necessary to conduct the research activities listed in this PWS. This work can be performed either on-site or off-site.

Scope of Work:

The contractor shall perform the following activities: The contractor shall assist EPA with the integration and testing of GEMM (EPA developed sustainability tool) tools with scientific, engineering, statistical, network. RTP (EPA) V2626umcth912 server is configured with second NIC with 134.67.216.31, http://ordgemm.epa.gov and v2626umcth912-2.rtord.epa.gov. NOTE: NO SOFTWARE DEVELOPMENT IS REQUIRED FOR SCIENTIFIC AND SECONDARY DATA MANAGEMENT IS THIS PWS.

The EPA, Sustainable Technology Division (STD) GEMM tool located on US EPA GitHub site @ (https://github.com/USEPA/GEMM) has been developed to work with additional modules and training tools (both COTS and independently developed) to include STD developed openLCA (https://github.com/USEPA/OpenLCA) and GREENSCOPE (http://greenscope.neptuneinc.org/). In addition, materials, which provide examples of the framework, integration and decision analysis process, user needs, and specific decision, needs for internal and external customers of the GEMM tools for the demonstrated application of identifying, quantifying, and facilitating the reuse of solvents in an industrial setting will be tested. The goal is to enable users of differing capacity to perform a complete decision analysis for their specific situation; therefore, all activities need to occur with this in mind. Programming and stakeholder/decision-maker involvement are expected to be on-going processes, continuing for years so these examples need to be flexible and adaptable over time.

The EPA ORD WACOR will prioritize needs and provide this information in written technical

direction to the contractor:

A) Use information from TRI and RTKNET.org to characterize current materials management practices by chemical and sector.

B) Identify sending facilities (able to provide solvent) and receiving facilities (those facilities with the capacity and need for this waste solvent).

C) Application of the GEMM model to calculate offset benefits from reduced material generation and consumption, transportation, and incineration operations.

D) EPA will review all calculations during and after completion of the work. The contractor shall address any comments, and address any issues that arise during the review process.

E) Assist EPA with updated QAPP S-21329-QP-1-0 that would include quality affecting changes to current version.

Quality Assurance:

The contractor shall use the Quality Assurance Project Plan with QA ID # S-21329-QP-1-0, entitled "Quality Assurance Project Plan for Green Engineering Outreach and Technical Support for the Chemical Engineering Branch." The contractor will be provided with a copy of the QAPP by the WAM. Contractor will assist with updates to EPA QAPP as needed when required by EPA QA requirements.

Deliverables:

The contractor shall provide copies of all scientific data used in their calculations as they are completed in software simulations. Provide updated version of QAPP S-21329-QP-1-0 (if applicable, i.e., during course of work quality affecting changes occur to project.)

The Contractor shall provide the following documentation, and perform the specified actions:

(1) Scientific database support for computer models;
(2) Reports, journal articles, and conference presentations;
(3) Work and test plan preparation;
(4) Life Cycle Assessments of existing chemical processes, etc.;
(5) Statistical design and data analysis.

Meetings:

The contractor shall hold monthly progress meetings with the EPA contract-level COR. During these progress meetings there will be discussion with the project on technical directions and modifications to the routine activities.

References

1. Billig, E. 2001. Butyl Alcohols. Kirk-Othmer Encyclopedia of Chemical Technology.
2. DeVito, S. C. 2007. Nitriles. Kirk-Othmer Encyclopedia of Chemical Technology.
3. Eastman, A. D. and Mears, D. 2000. Hydrocarbons, C1–C6. Kirk-Othmer Encyclopedia of Chemical Technology.
4. Gerberich, H. R. and Seaman, G. C. 2004. Formaldehyde. Kirk-Othmer Encyclopedia of Chemical Technology.
5. Holbrook, M. T. 2003. Methylene Chloride. Kirk-Othmer Encyclopedia of Chemical Technology.
6. Hwang, S. Y. and Chen, S. S. 2010. Cumene. Kirk-Othmer Encyclopedia of Chemical Technology. 1–10.
7. http://www.icis.com/Articles/2007/11/05/9076055/methyl-tertiary-butyl-ether-mtbe-production-and-manufacturing-process.html.
8. http://www.articlesbase.com/industrial-articles/the-synthesis-methods-of-tetrahydrofuran-2614552.html.
9. http://www.articlesbase.com/industrial-articles/the-synthesis-methods-of-tetrahydrofuran-2614552.html.
10. Krishnamurti, R. 2001. Chlorinated Benzenes. Kirk-Othmer Encyclopedia of Chemical Technology.
11. Marsella, J. A. 2000. Dimethylformamide. Kirk-Othmer Encyclopedia of Chemical Technology.
12. Sun, H. N. and Wristers, J. P. 2002. Butadiene. Kirk-Othmer Encyclopedia of Chemical Technology.
13. Vora, B. V., Kocal, J. A., Barger, P. T., Schmidt, R. J. and Johnson, J. A. 2003. Alkylation. Kirk-Othmer Encyclopedia of Chemical Technology.

PERFORMANCE WORK STATEMENT

Green Engineering Materials Management (GEMM), characterization of data, interpretation of data, and management of data.

CONTRACT NO. EP-C-15-010

WORK ASSIGNMENT NUMBER:	0-96, amendment 1
PERIOD OF PERFORMANCE:	Date of issue – September 29, 2016
WORK ASSIGNMENT MANAGER (WAM):	George Moore 513.569.7991 Moore.George@epa.gov
ALTERNATE WAM:	John Abraham 513-569-7124 Abraham.John@epa.gov
Location:	On-Site or Off-Site

Purpose:
The purpose of this amendment is to add tasks to the scope of work. See highlighted text below. All other items remain the same.

Background:

The Office of Research and Development (ORD) at US EPA has re-aligned its research activities into six new programs aimed at providing support to the Regions, Program Offices, States, Tribes, and communities who are charged with making decisions aimed at environmental sustainability. ORD created the Chemical Safety for Sustainability (CSS) Research Program to help ensure safety in the design, manufacture, and use of existing and future chemicals.

In addition, EPA's National Pollution Prevention (P2) Program and the Office of Chemical Substances and Pollution Prevention (OCSPP) are identifying opportunities to reuse certain hazardous secondary materials as a method of source reduction. The Green Engineering Materials Management (GEMM) analysis methodology is able to identify a subset of high-value secondary hazardous materials that can be readily recovered and managed as a chemical substance. This analysis is based on the remanufacturing exclusion proposed in the 2011 revisions to the Definition of Solid Waste rule.

This research's immediate focus is to highlight four solvents (methanol, toluene, acetonitrile, and dichloromethane) used in high volume by, among others, pharmaceutical manufacturers. Most of these solvents are destroyed after only one use and extending the life of these managed materials

generates significant benefits and lowers the potential for human health risk. This project seeks to enable facility managers and regulators to manage these materials as products, offsetting virgin materials produced by other manufacturers, thereby contributing to the reduction of significant greenhouse gas (GHG) impacts as a result of production of the virgin materials, using them only once, followed by their destruction.

Project Description with Software Simulation Goals for statistical testing and verification:

- Facilitate trial implementation via simulation in GEMM/LCA tool for the reuse of organic solvents used as reaction medium/agents in the pharmaceutical industry and others, as identified using the Green Engineering Materials Management (GEMM) approach.
- Test and deploy tools and training methods and materials to allow this approach to be transferred regionally and nationally, and to calculate GHG reductions from these new practices.

Purpose:

The purpose of this work assignment is to provide technical assistance to the EPA in conducting research, development, and evaluation studies.

Work Assignment Requirements:

The contractor shall furnish personnel and services necessary to conduct the research activities listed in this PWS. This work can be performed either on-site or off-site.

Scope of Work:

The contractor shall perform the following activities: The contractor shall assist EPA with the integration and testing of GEMM (EPA developed sustainability tool) tools with scientific, engineering, statistical, network. RTP (EPA) V2626umcth912 server is configured with second NIC with 134.67.216.31, http://ordgemm.epa.gov and v2626umcth912-2.rtord.epa.gov. NOTE: NO SOFTWARE DEVELOPMENT IS REQUIRED FOR SCIENTIFIC AND SECONDARY DATA MANAGEMENT IN THIS PWS.

The EPA, Sustainable Technology Division (STD) GEMM tool located on US EPA GitHub site @ (https://github.com/USEPA/GEMM) has been developed to work with additional modules and training tools (both COTS and independently developed) to include STD developed openLCA (https://github.com/USEPA/OpenLCA) and GREENSCOPE (http://greenscope.neptuneinc.org/). In addition, materials, which provide examples of the framework, integration and decision analysis process, user needs, and specific decision, needs for internal and external customers of the GEMM tools for the demonstrated application of identifying, quantifying, and facilitating the reuse of solvents in an industrial setting will be tested. The goal is to enable users of differing capacity to perform a complete decision analysis for their specific situation; therefore, all activities need to occur with this in mind. Programming and stakeholder/decision-maker

involvement are expected to be on-going processes, continuing for years so these examples need to be flexible and adaptable over time.

The EPA ORD WAM will prioritize needs and provide this information in written technical direction to the contractor:

A) Use information from TRI and RTKNET.org to characterize current materials management practices by chemical and sector.

B) Identify sending facilities (able to provide solvent) and receiving facilities (those facilities with the capacity and need for this waste solvent).

C) Application of the GEMM model to calculate offset benefits from reduced material generation and consumption, transportation, and incineration operations.

D) EPA will review all calculations during and after completion of the work. The contractor shall address any comments, and address any issues that arise during the review process.

E) Assist EPA with updated QAPP S-21329-QP-1-0 that would include quality affecting changes to current version.

The contractor shall provide two static IP addresses with 1 TB each storage dedicated hosting service (or cloud hosting service) for five-year cycle. Web server shall provide full control for independent verification and validation testing (user has root access for Linux/administrator access for Windows) as outlined below.

- Integration testing – Testing of integrated modules to verify combined functionality after integration. Modules are typically code modules, individual applications, client and server applications on a network, etc. Testing to be performed on host prior to deployment on US EPA RTP servers.
- End-to-end testing – Similar to system testing, involves testing of a complete application environment in a situation that mimics real-world use, such as interacting with a database, using network communications, or interacting with other hardware, applications, or systems as appropriate. Testing to be performed on static IP prior to deployment on RTP (EPA) V2626umcth912 server.
- Unit testing – Testing of individual software components or modules. Typically done by the programmer and not by testers, as it requires detailed knowledge of the internal program design and code. May require developing test driver modules or test harnesses on contractor IP.
- Incremental integration testing – Bottom up approach for testing i.e. continuous testing of an application as new functionality is added; Application functionality and modules shall be independent enough to test separately. This testing to be performed by GEMM/LCA programmers/testers.
- Sanity testing – Testing to determine if a new software version is performing well enough to accept it for a major testing effort. If application is crashing for initial use then system is not stable enough for further testing and build or application is assigned to fix. This testing to be performed by GEMM/LCA programmers/testers.
- Install/uninstall testing – Tested for full, partial, or upgrade install/uninstall processes on different operating systems under different hardware, software

environment. This testing to be performed by GEMM/LCA programmers/testers.

- Performance testing – Term often used interchangeably with 'stress' and 'load' testing. To check whether system meets performance requirements. Used different performance and load tools to do this. This testing to be performed by GEMM/LCA programmers/testers.
- Acceptance testing -Normally this type of testing is done to verify if system meets the customer specified requirements. User or customer do this testing to determine whether to accept application. This testing will be performed by Users granted access by GEMM Team Lead/Branch Chief.
- Usability testing – User-friendliness check. Application flow is tested, Can new user understand the application easily, Proper help documented whenever user stuck at any point. Basically system navigation is checked in this testing. This testing will be performed by Users granted access by GEMM Team Lead/Branch Chief.

Quality Assurance:
The contractor shall use the Quality Assurance Project Plan with QA ID # S-21329-QP-1-0, entitled "Quality Assurance Project Plan for Green Engineering Outreach and Technical Support for the Chemical Engineering Branch." The contractor will be provided with a copy of the QAPP by the WAM. Contractor will assist with updates to EPA QAPP as needed when required by EPA QA requirements.

Deliverables:
The contractor shall provide copies of all scientific data used in their calculations as they are completed in software simulations. Provide updated version of QAPP S-21329-QP-1-0 (if applicable, i.e., during course of work quality affecting changes occur to project.)

The Contractor shall provide the following documentation, and perform the specified actions:
(1) Scientific database support for computer models;
(2) Reports, journal articles, and conference presentations;
(3) Work and test plan preparation;
(4) Life Cycle Assessments of existing chemical processes, etc.;
(5) Statistical design and data analysis.

Meetings:
The contractor shall hold monthly progress meetings with the EPA project officer. During these progress meetings the there will be discussion with the project on technical directions and modifications to the routine activities.

References

1. Billig, E. 2001. Butyl Alcohols. Kirk-Othmer Encyclopedia of Chemical Technology.
2. DeVito, S. C. 2007. Nitriles. Kirk-Othmer Encyclopedia of Chemical Technology.
3. Eastman, A. D. and Mears, D. 2000. Hydrocarbons, C1–C6. Kirk-Othmer Encyclopedia of Chemical Technology.
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