EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 3-36

☐ Other ☐ Amendment Number:

Contract Number	Contract Period	Title of Work Assignment/SF Site Name
EP-D-14-032	09/16/2014 To 09/15/2019 Base Option Period Number 3	Tech&Mod_Resilient Infrast

Contractor: INDUSTRIAL ECONOMICS, INCORPORATED

Specify Section and paragraph of Contract SOW: Section 4 and 6

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

Period of Performance: From 09/16/2017 To 09/15/2018

Comments:

THE WORK ASSIGNMENT INCLUDES 400 HOURS FOR PREPARATION OF THE WORKPLAN/COST ESTIMATE AND TO BEGIN THE WORK ASSIGNMENT. THE CONTRACTOR SHALL PROPOSE THE HOURS NECESSARY TO COMPLETE ALL TASKS. NO PREVIOUSLY PERFORMED WORK SHALL BE DUPLICATED. SEE ATTACHED SOW.

☐ 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: 09/16/2014 To 09/15/2019 Cost/Fee: LOE:

This Action:

Total:

Work Plan / Cost Estimate Approvals

Contractor WP Dated: Cost/Fee LOE:

Cumulative Approved: Cost/Fee LOE:

Work Assignment Manager Name Jeremy Martinich (Signature) (Date)	Branch/Mail Code: Phone Number: 202-343-9871 FAX Number:	
Project Officer Name Carolyn Blake (Signature) (Date)	Branch/Mail Code: Phone Number: 919-541-5256 FAX Number:	
Other Agency Official Name (Signature) (Date)	Branch/Mail Code: Phone Number: FAX Number:	
Contracting Official Name Natalia Fisher-Jackson NATALIA FISHER-JACKSON (Signature) (Date)	Digitally signed by NATALIA FISHER-JACKSON DN: c=US, o=U.S. Government, ou=USEPA, ou=Staff, cn=NATALIA FISHER-JACKSON, dnQualifier=0000016076 Date: 2017.08.15 11:07:21 -04'00'	Branch/Mail Code: Phone Number: 919-541-3564 FAX Number:

Statement of Work

I.	Title:	**Technical and Modeling Support for Resilient Infrastructure Analysis**
	Contractor Name:	**Industrial Economics, Inc (IEc)**
	Contract #:	**IEc EP-D-14-032**
	WA #:	**3-36**

II. Work Assignment Manager (WAM):

Jeremy Martinich
U.S. Environmental Protection Agency
Office of Atmospheric Programs
Climate Change Division (6207-A)
1200 Pennsylvania Ave, NW
Washington, DC 20460
(202) 343-9871
martinich.jeremy@epa.gov

This purpose of this follow-on Work Assignment (WA) #2-32 is to continue resilient infrastructure modeling in the U.S.

III. Description and Tasks:

Task #1: Develop Workplan and Project Management

The Contactor shall provide a workplan outlining the approach, resources, timeline, and estimated costs for all tasks listed below. Estimates of costs and hours shall be presented by professional level and month. The WAM will review the workplan and will request revisions and or changes as needed. If necessary, the Contractor shall incorporate EPA comments into the final workplan.

The Contractor shall provide project management under this task. During the period of performance, the Contractor shall immediately inform the WAM, PO and CO by telephone and/or email of any problems that may impede performance along with any corrective actions needed by the EPA or the Contractor to solve the problem.

Under this task, the Contractor shall also attend a kick-off meeting via conference call to discuss the goals and strategy for completing future deliverables. This kick-off meeting will serve as a discussion to clarify the EPA's requirements, solicit ideas and feedback from the Contractor, as well as formulate ideas for work to be completed by the Contractor under the Tasks listed below.

Deliverables:

- Participate in Kick-off Meeting
- Workplan and cost estimate to EPA
- Monthly Status Reports

Task #2: Complete and Publish Infrastructure Resilience Modeling Analysis

Under Work Assignment #2-32, the Contractor developed a detailed methodology for conducting a resilient infrastructure analysis using a number of the CIRA infrastructure impact models. Using the ten CIRA2.0 projections, the objective of this work is to apply a consistent scenario framework to investigate the implications of no adaptation, reactive adaptation, and proactive adaptation on multiple infrastructure types. This analysis is intended to quantify economic impacts associated with repairs/retrofits (reactive or proactive adaptation) and economic disruptions associated with indirect effects (e.g., delays).

At the end of Option Period 2, the Contractor had successfully developed the project methodology, addressed comments from the WAM, and began to move forward with initial steps of the plan. The purpose of this Task is to complete the modeling analysis, conduct sensitivity analyses, perform quality assurance checks, document all methods and results, and support EPA in submitting a manuscript to a peer reviewed journal. Each of these steps are described in detail below.

- Conduct and Complete Modeling Analysis: The Contractor shall apply existing CIRA infrastructure sectoral models (roads, bridges, rail, urban drainage, coastal property) to conduct this analysis. The Contractor shall also implement Task 3 described below with the intention of including the electricity disruption modeling into this broader infrastructure effort under Task 2. The Contractor shall also quantify inter-sectoral and connectivity impacts to the extent practicable. The Contractor shall produce results for a full time series of values through 2100 where possible (in net present value and undiscounted terms), otherwise for time periods centered on the following years: 2030, 2050, 2070, 2090. The sectoral impact analyses should explicitly account for changing socioeconomics, specifically changes in population and economic growth using the CIRA2.0 projections for these parameters. The Contractor shall deliver results that reflect impacts with and without these changing socioeconomics so that all effects can be isolated (and so that the results can be easily used in future CIRA reduced-form applications).
- Conduct Sensitivity Analyses: The plan for modeling should also evaluate the practicality and modeling capability of incorporating dynamic socioeconomic future conditions, such as increasing the user base of infrastructure (i.e., population growth), and expanding infrastructure networks (i.e., new roads or increased development in the coastal floodplain).
- Perform and Document Quality Assurance Checks: The Contractor shall work closely with the modeling team to perform and document quality checks of all sectoral output data to ensure that the results are accurate and complete.
- Document all Methods and Results: The Contractor shall carefully document all methods, data sources, and limitations for inclusion in the peer-reviewed manuscript (either in main text or extended supplementary information). The Contractor shall also develop clear and well-organized spreadsheets of data documenting the outputs from each sectoral model (for use in later applications) and the summarized results for use in the manuscript.
- Publication: The Contractor shall work with the WAM in developing a manuscript for publication of this infrastructure resiliency analysis in a peer-reviewed journal. The Contractor shall plan for paying open access publication fees.

Task 2 Deliverables:

- Spreadsheets of summarized data and results.
- Spreadsheets of raw output data and modeling results
- Text and figure components of manuscript for publication.

Task #3: Impacts to U.S. Electricity Distribution Infrastructure

The purpose of this Task is to develop and implement new methods for quantifying impacts to electricity distribution infrastructure in the U.S. The Contractor shall apply a process-based and engineering approach in conducting this analysis by developing damage functions that define the relationships between climate and infrastructure lifespan reduction, and power interruption occurrence and duration. This analysis should target three specific effects: 1) positive and negative impacts to infrastructure lifespan (and the associated capital/O&M costs to electric utilities); 2) costs of outages/service interruptions to residential, commercial, and industrial customers; and 3) inefficiencies in the distribution network that compound vulnerability. Consistent with the approach taken in Task 2 above, this analysis should explicitly assess the effect of adaptation (reactive and proactive) in reducing overall vulnerability/costs (comparing no adaptation to these response scenarios).

The Contractor shall develop a detailed methodology memo, conduct the modeling analysis, conduct sensitivity analyses, perform quality assurance checks, document all methods and results, and support EPA in submitting a manuscript to a peer reviewed journal. Each of these steps are described in detail below.

- Proposed Methodology Memo: Working with technical experts in the field, the Contractor shall develop a detailed methodology and modeling plan for approval by EPA. This plan shall clearly describe the modeling components, the design/structure of the mitigation and adaptation scenario framework, the specific categories of results produced by each scenario, a consideration of how the model outputs could inform the ReEDS model, and a detailed schedule of milestones. The Contractor shall submit the memo to the WAM for approval and revise accordingly based on any comments or concerns raised.
- Conduct and Complete Modeling Analysis: Using the 10 CIRA2.0 projections (2 RCPs x 5GCMs), the Contractor shall implement the approach described in the agreed-upon memo. The Contractor shall produce results for a full time series of values through 2100 to the maximum extent possible (in net present value and undiscounted terms), or otherwise for time periods centered on the following years: 2030, 2050, 2070, 2090. The analysis should explicitly account for changing socioeconomics, specifically changes in population and economic growth using the CIRA2.0 projections for these parameters. The Contractor shall deliver results that reflect impacts with and without these changing socioeconomics so that all effects can be isolated (and so that the results can be easily used in future CIRA reduced-form applications).
- Perform and Document Quality Assurance Checks: The Contractor shall work closely with the modeling team to perform and document quality checks of all sectoral output data to ensure that the results are accurate and complete.

- Document all Methods and Results: The Contractor shall carefully document all methods, data sources, and limitations for inclusion in the peer-reviewed manuscript (either in main text or extended supplementary information). The Contractor shall also develop clear and well-organized spreadsheets of data documenting the outputs from each sectoral model (for use in later applications) and the summarized results for use in the manuscript. The Contractor shall work to ensure that results are made immediately available for use in the infrastructure resiliency work described in Task 2 above.
- Publication: The Contractor shall work with the WAM in developing a manuscript describing the methods and results of this electricity distribution analysis for publication in a peer-reviewed journal. The Contractor shall plan for paying open access publication fees.

Task 3 Deliverables:

- Proposed methodology memo.
- Spreadsheets of summarized data and results.
- Spreadsheets of raw output data and modeling results
- Draft manuscript for publication.

Task #4: Technical Support and Quick Turnaround Assistance

As the above tasks proceed, EPA is likely to require technical support and quick turnaround assistance related to the work outlined in this WA. The Contractor shall be expected to perform two of these technical support tasks, each requiring approximately 20-30 hours of work. As requested per technical direction from the WAM, the Contractor shall support EPA by:

- Providing background materials for presentations/briefings.
- Paying open access publication fees for publications.
- Small technical analysis related to the subjects of this work assignment.

As stated above, this work will be initiated through technical direction, and these communications will include specific details regarding the work, including delivery dates.

Task 4 Deliverables:

- As described in technical direction from the WAM

IV. Deliverables:

The Contractor shall adhere to the following schedule:

Task	Deliverable	Delivery Schedule
1	Kickoff call	Within 5 days of effective date of WA
1	Work plan	20 days after effective date of WA

1	Monthly status reports	TBD based on coordination with CO/WAM
2	Spreadsheets of summarized data & results	150 days after effective date of WA
2	Spreadsheets of raw output	150 days after effective date of WA
2	Manuscript components	30 days after completion of modeling
3	Proposed methodology memo	60 days after effective date of WA
3	Spreadsheets of summarized data & results	150 days after effective date of WA
3	Spreadsheets of raw output	150 days after effective date of WA
3	Draft manuscript	30 days after completion of modeling
4	Quick turnaround deliverables	TBD based on technical direction

V. 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 form.

VI. QA Requirements:

The Contractor shall include a quality assurance section in the final deliverable discussing the data used with respect to precision, accuracy, representativeness, comparability, completeness, sensitivity and appropriateness as it applies to this use and its source. The QA section will discuss how the Contractor and the Agency ensured that the environmental data were of acceptable quality and that they were being used for the purpose for which they were collected.

EPA

United States Environmental Protection Agency
Washington, DC 20460

Work Assignment

Work Assignment Number: 3-36

☐ Other ☐ Amendment Number:

Contract Number: EP-D-14-032

Contract Period: 09/16/2014 To 09/15/2019

Base Option Period Number: 3

Title of Work Assignment/SF Site Name: Tech&Mod_Resilient Infrast

Contractor: INDUSTRIAL ECONOMICS, INCORPORATED

Specify Section and paragraph of Contract SOW: Section 4 and 6

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

Period of Performance: From 09/16/2017 To 09/15/2018

Comments:
The work plan and cost estimate dated 10/12/2017 have been received, reviewed, and approved for 2,128 hours and $226,551.34. No previously performed work shall be duplicated.

☐ 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: 09/16/2014 To 09/15/2019	Cost/Fee: $0.00	LOE: 0	
This Action:	$226,551.34	2,128	
Total:	$226,551.34	2,128	

Work Plan / Cost Estimate Approvals

Contractor WP Dated: 10/12/2017	Cost/Fee $226,551.34	LOE: 2,128	
Cumulative Approved:	Cost/Fee $226,551.34	LOE: 2,128	

Work Assignment Manager Name: Jeremy Martinich	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 202-343-9871
			FAX Number:
Project Officer Name: Carolyn Blake	(Signature)	(Date)	Branch/Mail Code:
			Phone Number: 919-541-5256
			FAX Number:
Other Agency Official Name	(Signature)	(Date)	Branch/Mail Code:
			Phone Number:
			FAX Number:
Contracting Official Name: Natalia Fisher-Jackson	Natalia Fisher Jackson (Signature)	11/13/2017 (Date)	Branch/Mail Code:
			Phone Number: 919-541-3564
			FAX Number: