
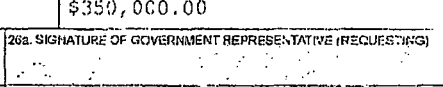


<b>INTERAGENCY AGREEMENT</b>		1. IAA NO. NRC-HQ-25-16-T-0012		PAGE OF 1   3		
2. ORDER NO.		3. REQUISITION NO. NRO-16-0089		4. SOLICITATION NO.		
5. EFFECTIVE DATE 08/16/2016		6. AWARD DATE 08/16/2016		7. PERIOD OF PERFORMANCE 10/01/2016 TO 05/31/2018		
8. SERVICING AGENCY BROOKHAVEN NATIONAL LABORATORY ALC: DUNS: 027579460 +4: BROOKHAVEN SITE OFFICE PO BOX 5000 BLDG 464 UPTON NY 11973-5000  POC Kim Nekulak TELEPHONE NO. 631-344-7439			9. DELIVER TO MARIELIZ A VERA US NUCLEAR REGULATORY COMMISSION 11555 ROCKVILLE PIKE MAILSTOP TWFN 6 C32 ROCKVILLE MD 20852			
10. REQUESTING AGENCY ACQUISITION MANAGEMENT DIVISION ALC: 31000001 DUNS: 040535809 +4: US NUCLEAR REGULATORY COMMISSION ONE WHITE FLINT NORTH 11555 ROCKVILLE PIKE ROCKVILLE MD 20852-2738  POC SHASHI MALHOTRA TELEPHONE NO. 301-415-7803			11. INVOICE OFFICE US NUCLEAR REGULATORY COMMISSION ONE WHITE FLINT NORTH 11555 ROCKVILLE PIKE MAILSTOP 03-E17A ROCKVILLE MD 20852-2738			
12. ISSUING OFFICE US NRC - HQ ACQUISITION MANAGEMENT DIVISION MAIL STOP TWFN-5E03 WASHINGTON DC 20555-0J01			13. LEGISLATIVE AUTHORITY Energy Reorganization Act of 1974			
			14. PROJECT ID			
			15. PROJECT TITLE SEE BLOCK 18			
16. ACCOUNTING DATA 2016-X02C0-FEEBASED-25-25D008-17-4-151-1030-251D						
17. ITEM NO.	18. SUPPLIES/SERVICES		19. QUANTITY	20. UNIT	21. UNIT PRICE	22. AMOUNT
	TASK ORDERING AGREEMENT: NRC-HQ-25-14-D-0002 TASK ORDER NUMBER: NRC-HQ-25-16-T-0012  The NRC and the DOE Lab (BNL) hereby enter into this Agreement/Task Order, NRCHQ2514D0002-NRC-HQ-25-16-T-0012, for the project entitled, Small Modular Reactor Technical Guidance Support  The performance period for this agreement shall commence on October 1, 2016 and will expire on May 31, 2018. Continued ...					
23. PAYMENT PROVISIONS			24. TOTAL AMOUNT \$350,000.00			
25a. SIGNATURE OF GOVERNMENT REPRESENTATIVE (SERVICING) 			25b. SIGNATURE OF GOVERNMENT REPRESENTATIVE (REQUESTING) 			
25d. NAME AND TITLE Kim M. Nekulak Contracting Officer		25c. DATE AUG 17 2016	26b. CONTRACTING OFFICER FERREY R. MITCHELL		26c. DATE	

TEMPLATE - ADM001

SUNSI REVIEW COMPLETE

SEP - 8 2016

ADM102

<b>INTERAGENCY AGREEMENT</b>		1. IAA NO. NRC-HQ-25-16-T-0012			PAGE OF 1 3	
2. ORDER NO.		3. REQUISITION NO. NRO-16-0089		4. SOLICITATION NO.		
5. EFFECTIVE DATE 08/16/2016		6. AWARD DATE 08/16/2016		7. PERIOD OF PERFORMANCE 10/01/2016 TO 05/31/2018		
8. SERVICING AGENCY BROOKHAVEN NATIONAL LABORATORY ALC: DUNS: 027579460 +4: BROOKHAVEN SITE OFFICE PO BOX 5000 BLDG 464 UPTON NY 11973-5000  POC Kim Nekulak TELEPHONE NO. 631-344-7439				9. DELIVER TO MARIELIZ A VERA US NUCLEAR REGULATORY COMMISSION 11555 ROCKVILLE PIKE MAILSTOP TWFN 6 C32 ROCKVILLE MD 20852		
10. REQUESTING AGENCY ACQUISITION MANAGEMENT DIVISION ALC: 31000001 DUNS: 040535809 +4: US NUCLEAR REGULATORY COMMISSION ONE WHITE FLINT NORTH 11555 ROCKVILLE PIKE ROCKVILLE MD 20852-2738  POC SHASHI MALHOTRA TELEPHONE NO. 301-415-7803				11. INVOICE OFFICE US NUCLEAR REGULATORY COMMISSION ONE WHITE FLINT NORTH 11555 ROCKVILLE PIKE MAILSTOP O3-E17A ROCKVILLE MD 20852-2738		
12. ISSUING OFFICE US NRC - HQ ACQUISITION MANAGEMENT DIVISION MAIL STOP TWFN-5E03 WASHINGTON DC 20555-0001				13. LEGISLATIVE AUTHORITY Energy Reorganization Act of 1974		
				14. PROJECT ID		
				15. PROJECT TITLE SEE BLOCK 18		
16. ACCOUNTING DATA 2016-X0200-FEEBASED-25-25D008-17-4-151-1030-251D						
17. ITEM NO.	18. SUPPLIES/SERVICES			19. QUANTITY	20. UNIT	21. UNIT PRICE
	TASK ORDERING AGREEMENT: NRC-HQ-25-14-D-0002. TASK ORDER NUMBER: NRC-HQ-25-16-T-0012  The NRC and the DOE Lab (BNL) hereby enter into this Agreement/Task Order, NRCHQ2514D0002-NRC-HQ-25-16-T-0012, for the project entitled, Small Modular Reactor Technical Guidance Support  The performance period for this agreement shall commence on October 1, 2016 and will expire on May 31, 2018. Continued ...					
23. PAYMENT PROVISIONS				24. TOTAL AMOUNT \$850,000.00		
25a. SIGNATURE OF GOVERNMENT REPRESENTATIVE (SERVICING)				26a. SIGNATURE OF GOVERNMENT REPRESENTATIVE (REQUESTING)		
25b. NAME AND TITLE		25c. DATE		26b. CONTRACTING OFFICER JEFFREY R. MITCHELL		26c. DATE 8/16/2016

Consideration and Obligations:

(a) Authorized Cost Ceiling \$389,260.00.

(b) The amount presently obligated with respect to this DOE Agreement is \$350,000.00 . When and if the amount(s) paid and payable to the DOE Laboratory hereunder shall equal the obligated amount, the DOE Laboratory shall not be obligated to continue performance of the work unless and until the NRC Contracting Officer shall increase the amount obligated with respect to this DOE Agreement. Any work undertaken by the DOE Laboratory in excess of the obligated amount specified above is done so at the DOE Laboratory's sole risk.

The following documents are hereby made part of this Agreement:

Attachment No. 1: Statement of Work

BNL PROJECT MANAGER: Mr. W. Horak  
BNL's Principal Investigator: Mr. Richard Morante  
CONTRACTING OFFICERS REPRESENTATIVE (COR):Ms.  
Marieliz A. Vera

DUNS:040535809  
TAS:31X0200.320  
ALC:31000001

This agreement is entered into pursuant to the authority of the Energy Reorganization Act of 1974, as amended (42 U.S.C 5801 et seq.). This work will be performed in accordance with the NRC/DOE Memorandum of Understanding dated November 24, 1998. To the best of our knowledge, the work requested will not place the DOE and its contractor in direct competition with the domestic private sector.

[ ] Fee Recoverable Work  
[ x ] Non-fee Recoverable Work

Notwithstanding the agreement effective dates and period of performance start dates stated elsewhere in the agreement, the effective date of Continued ...

the agreement and start date of the period of performance are the last date of signature by the parties.

Master IAA: NRCHQ2514D0002

00001	Authorized Cost Ceiling Line Item Ceiling \$389,260.00 Incrementally Funded Amount: \$350,000.00	389,260.00
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The total amount of award: \$389,260.00. The obligation for this award is shown in box 24.

**STATEMENT OF WORK (SOW)**

<b>NRC Agreement Number</b>  NRC-HQ-25-14-D-0002	<b>NRC Agreement Modification Number</b>  	<b>NRC Task Order Number (If Applicable)</b>  NRC-HQ-25-16-T-0012	<b>NRC Task Order Modification Number (If Applicable)</b>  
<b>Project Title</b> Small Modular Reactor Technical Guidance Support			
<b>Job Code Number</b> 1030	<b>B&amp;R Number</b> 17-4-151	<b>Servicing Agency</b> Brookhaven National Laboratory	
<b>NRC Requisitioning Office</b> NRO/DEIA		<b>Period of Performance</b> October 2016 through May 2018	
<b>NRC Form 187, Contract Security and Classification Requirements</b> <input type="checkbox"/> Applicable <input checked="" type="checkbox"/> Not Applicable		<input type="checkbox"/> Involves Proprietary Information <input type="checkbox"/> Involves Sensitive Unclassified	
<input checked="" type="checkbox"/> Non Fee-Recoverable		<input type="checkbox"/> Fee-Recoverable (If checked, complete all applicable sections below)	
<b>Docket Number (If Fee-Recoverable/Applicable)</b>		<b>Inspection Report Number (If Fee Recoverable/Applicable)</b>	
<b>Technical Assignment Control Number (If Fee-Recoverable/Applicable)</b>		<b>Technical Assignment Control Number Description (If Fee-Recoverable/Applicable)</b>	

**1.0 BACKGROUND**

The Nuclear Regulatory Commission (NRC) regulates the construction and operation of new commercial nuclear power facilities. The Office of New Reactors (NRO) serves the public interest by enabling the safe, secure, and environmentally responsible use of nuclear power in meeting the Nation's future energy needs. NRO supports the mission to protect public health, safety, and the environment by leading and managing the licensing activities associated with small modular reactor (SMR) designs.

Current interest in SMRs has led to the development of a number of configurations that are small and modularized with flexibility to be expanded within the same foot-print by the addition of more reactor modules. Unlike the conventional light water reactors (LWR), the reactor building of a SMR is a deeply embedded pool type structure enclosing a steel containment pressure vessel which houses the reactor vessel within it. The embedded reactor building also provides space for refueling activities.

With the increased focus on SMRs, the NRC expects to begin licensing reviews of SMRs as early as 2016 and as such, should be prepared for addressing any potential review challenges that could be posed by the non-traditional LWR configuration and siting condition (i.e., completely embedded structure) in a timely manner. In order for the staff to focus on the critical areas during the review and complete its review in a timely manner, it would be necessary for the staff to be aware of the critical areas of the review earlier in the review process.

The NRC has developed regulatory framework (e.g., DSRS for a limited set of SMRs) needed to review SMRs primarily based on the current guidance of NUREG-800 considering some of the differences between the large LWRs and the SMRs. However, in the absence of any prior experience in implementing the revised framework, the staff does not have the specific insights into the critical structural review areas for the SMRs. Prior knowledge of the critical areas of the review for this type of design would allow the staff to more effectively conduct the review in a timely manner.

## **2.0 OBJECTIVE**

The objective of this task order agreement is to obtain technical assistance to address potential near-term issues related to NRC regulatory reviews of the seismic design of the SMRs in light of the differences in configuration between the current LWR configurations and SMRs.

The DOE laboratory shall:

1. Prepare a report that includes the technical issues that can be encountered in reviewing an SMR
2. Evaluate the existing guidance and update as needed depending on the results of the study
3. Determine and clarify the applicability of codes, standards, and criteria needed for SMRs

The primary written deliverable will consist of a two part report; the first will address the findings of the study made including the structural analysis and design differences between a conventional LWR and an SMR, and the second part will provide information as to whether the current guidance needs to be modified to accommodate any of the findings and the applicability of current codes and standards.

The specific work scope and schedule required for this task order are provided in Sections 1, 2 and 3. The requirements for communicating work progress and status are provided in Section 8.

## **3.0 SCOPE OF WORK/TASKS**

The servicing agency shall provide all resources necessary to accomplish the tasks and deliverables described in this Statement of Work (SOW).

The DOE laboratory shall provide support to NRO in a wide range of technical and scientific disciplines aimed at ensuring the overall safety and adequacy of advanced nuclear power plant design, construction, and operations. The scope of work is described in the tasks below.

### **Task 1: Kickoff Meeting**

Prior to the initiation of work, the NRC COR will conduct a kickoff meeting with the DOE Laboratory to discuss the project.

The purpose is to have alignment and propose potential adjustments to the SOW based on the projected workload and demands.

### **Task 2: Prepare a report that includes the technical issues that can be encountered in reviewing an SMR**

Following technical direction provided by the NRC, the DOE Laboratory shall review conceptual structural drawings for the SMRs and identify critical areas of seismic review for SMRs. Develop simplified conceptual model for seismic analysis and design, and perform dynamic soil-structure interaction (SSI) analysis using representative input spectra (RG 1.60 and CEUS) for two different site conditions (soil site and rock site) and identify critical modeling aspects that should be reflected in the seismic analysis and design model. Consider in the analysis the effect of soil separation and variation of soil parameters. Use the control point of the input at the bottom of the foundation. The DOE Laboratory shall write a report that addresses the details of the review process performed, including the structural analysis and design differences between a conventional LWR and an SMR. The study will provide insight to the technical

staff, specifying the areas of focus that would provide a reasonable path to understanding the behavior of the structural configurations under design loads. The study needs to focus on, but should not be limited to, the following issues:

1. The behaviour of high strength concrete and its impact on structural performance
2. The impact of staggered reactor module installation on the design of the basemat
3. The need for additional check points to be used in confirming the consistency of soil column analysis, location of input motion etc.
4. Computation of dynamic soil pressure, soil wall separation
5. Effect of loads from adjacent structure on the soil stress state and its influence in the SSI analysis
6. Hydrodynamic effects on the walls of the reactor building including consideration of impactive and sloshing load and its potential effect on the design reactor building and the internal structures in the pool
7. Potential effect of adjacent structure on the design of RB.

**Task 3: Evaluation of existing guidance**

Evaluate the existing guidance that supports the regulatory infrastructure for applications, such as the SMRs; and update the guidance as needed based on the results obtained in Task 2.

**Task 4: Industry Codes and Standards**

The DOE Laboratory shall support NRC staff by participating in meetings (if needed) with stakeholders (standards organizations, vendors, etc.) to determine and clarify the applicability of codes, standards, and criteria needed for SMRs.

**4.0 LIST OF DELIVERABLES**

<b>Task</b>	<b>Deliverables</b>	<b>Deliverable Format</b>	<b>Scheduled Completion*</b>
1. Kick-off Meeting			Within two weeks of being awarded the contract.
2. Prepare a report that includes the technical issues that can be encountered in reviewing an SMR	Task plan	Microsoft Word	Two weeks from when NRC assigns the task.
	Draft report with progress on the studies	Microsoft Word	Once a month from when NRC assigns the task.
	Final Report including all studies made and the differences between a conventional LWR and SMRs structural/seism analysis	Microsoft Word	Seven months from when NRC assigns the task.
3. Evaluation of existing guidance	Review existing guidance	Microsoft Word	Four weeks after completion of Task 2.
	Draft update of existing guidance	Microsoft Word	Three Months after completion of Task 2.
	Final update of existing guidance	Microsoft Word	Four Months after completion of Task 2.
4. Codes and Standards	Report with applicability of codes and standards (if needed)	Microsoft Word	Four weeks after completion of Task 3.

The report will consist of two parts; the first will address the findings in Task 2 and the second part, will provide information as to whether the current guidance needs to be modified to accommodate any of the findings and the applicability of current codes and standards.

## **5.0 ESTIMATED LABOR CATEGORIES, KEY PERSONNEL AND LEVELS OF EFFORT**

**5.1 Labor Categories, Requirements and Key Personnel.** The work requires personnel with expertise in the area of structural analysis and design.

Knowledge and experience in high strength concrete, computation of dynamic soil pressure- soil wall separation, hydrodynamic effects, structural design and analysis of Category I nuclear structures and mat foundations for various load combinations, modeling of complicated structures, finite element structural analysis methods, use of sophisticated structural analysis computer codes, implementation of NRC regulations, use of US industry codes and standards applicable for design and construction of nuclear power plants.

Knowledge and ability to create "plain language" guidance to NRC staff reviewers and NRC applicants that reflects risks posed by SMR technology is required.

## **6.0 CERTIFICATION AND LICENSE REQUIREMENTS**

N/A

## **7.0 TECHNICAL AND OTHER SPECIAL QUALIFICATIONS REQUIRED**

The DOE laboratory shall provide individuals who have the required educational background and work experience to meet the objectives of the work specified in this task order. Specific qualifications for this effort include:

Senior structural engineers with knowledge and experience in design and analysis of nuclear steel and concrete containment and other Category I structures, systems, and mat foundations for various load combinations, modeling of complicated structures, finite element structural analysis methods, use of sophisticated structural analysis computer codes, implementation of NRC regulations, use of US industry codes and standards applicable for design and construction of nuclear power plants.

The NRC will rely on representations made by the laboratory concerning the qualifications of the personnel assigned to this task order, including assurance that all information contained in the technical and cost proposals, including resumes, is accurate and truthful. The resume for each professional proposed to work under this task order (principal investigators, technical staff, employees, consultants, specialists or subcontractors) shall describe the individual's experience in applying his or her area of engineering specialization to work in the proposed area. The use of particular personnel on this task order is subject to the NRC COR's approval. This includes any proposed changes to key personnel during the life of the task order.

## **8.0 MEETINGS AND TRAVEL**

Servicing agency personnel will be authorized travel expenses consistent with the Federal Travel Regulation (FTR) and the limitation of funds specified for the travel within this agreement/order. All travel requires prior written approval from the COR.

Foreign travel for the servicing agency personnel requires a 60-day lead time for NRC approval. For prior approval of foreign travel, the servicing agency shall submit to the COR an NRC Form 445, "Request for Approval of Official Foreign Travel." NRC Form 445 is available in the MD 11.7 Documents library and on the NRC Web site at: <http://www.nrc.gov/reading-rm/doc-collections/forms/>. All foreign travel requires prior written approval from the NRC Executive Director for Operations (EDO).



FY17

- One, two-person, one-day trip to discuss report before finalization.

## **9.0 REPORTING REQUIREMENTS**

The servicing agency is responsible for structuring the deliverables to current agency standards. Deliverables shall be submitted free of spelling and grammatical errors and shall conform to requirements stated in this section.

### **8.1 Monthly Letter Status Report (MLSR)**

The servicing agency shall provide a Monthly Letter Status Report which consists of a technical progress report and financial status report and submit electronically by the 20<sup>th</sup> day of each month. The report will be used by the sponsoring agency to assess the adequacy of the resources utilized by the servicing agency to accomplish the work contained in this SOW and to provide status of the servicing agency progress in achieving tasks and producing deliverables. The report shall include agreement/order summary information, work completed during the specified period, milestone schedule information, problem identification and resolution, travel plans, and staff hour summary. Copies of MLSR shall be sent to the COR and AMD at ContractsPOT.Resource@nrc.gov.

## **10.0 REQUIRED MATERIALS, FACILITIES, HARDWARE/SOFTWARE**

N/A

## **11.0 APPLICABLE PUBLICATIONS (CURRENT EDITIONS)**

The servicing agency shall comply with the following applicable regulations, publications, manuals, and local policies and procedures:

1. NUREG-1379, "NRC Editorial Style Guide", Rev.2 (May 2009)

## **12.0 DATA RIGHTS**

The NRC shall have unlimited rights to and ownership of all deliverables provided under this agreement/order, including reports, recommendations, briefings, work plans and all other deliverables. All documents and materials, to include the source codes of any software, produced under this agreement/order are the property of the NRC with all rights and privileges of ownership/copyright belonging exclusively to the NRC. These documents and materials may not be used or sold by the servicing agency without prior written authorization from the CO. All materials supplied to the NRC shall be the sole property of the NRC and may not be used for any other purpose. This right does not abrogate any other Government rights.

## **13.0 PERIOD OF PERFORMANCE**

See Block 7 on the IAA award form.

## **14.0 CONTRACTING OFFICER'S REPRESENTATIVE**

### Contracting Officer's Representative

Name: Marieliz Vera

Agency: U.S. Nuclear Regulatory Commission

Office: NRO/DEIA/SEB  
Mail Stop: TWFN 6C32  
Washington, DC 20555-0001  
E-Mail: marieliz.vera@nrc.gov  
Phone: (301) 415-5861  
Washington, DC 20555-0001

Alternate Contracting Officer's Representative

Name: Vaughn Thomas  
Agency: U.S. Nuclear Regulatory Commission  
Office: NRO/DEIA/SEB  
Mail Stop: TWFN 6C32  
Washington, DC 20555-0001  
E-Mail: vaughn.thomas@nrc.gov  
Phone: (301) 415-5897  
Washington, DC 20555-0001

The COR monitors all technical aspects of the agreement and assists in its administration. The COR is authorized to perform the following functions: assure that the DOE Laboratory performs the technical requirements of the agreement; perform inspections necessary in connection with agreement performance; maintain written and oral communications with the DOE Laboratory concerning technical aspects of the agreement; issue written interpretations of technical requirements, including Government drawings, designs, specifications; monitor the DOE Laboratory's performance and notify the DOE Laboratory of any deficiencies; coordinate availability of NRC-furnished material and/or GFP; and provide site entry of DOE Laboratory personnel.

**15.0 NRC-FURNISHED PROPERTY/MATERIALS**

N/A

**16.0 STANDARDS FOR CONTRACTORS WHO PREPARE NUREG-SERIES MANUSCRIPTS**

The U.S. Nuclear Regulatory Commission (NRC) began to capture most of its official records electronically on January 1, 2000. The NRC will capture each final NUREG-series publication in its native application. Therefore, please submit your final manuscript that has been approved by your NRC Project Manager in both electronic and camera-ready copy.

The final manuscript shall be of archival quality and comply with the requirements of NRC Management Directive 3.7 "NUREG-Series Publications." The document shall be technically edited consistent with NUREG-1379, Rev. 2 (May 2009) "NRC Editorial Style Guide." The goals of the "NRC Editorial Style Guide" are readability and consistency for all agency documents.

All format guidance, as specified in NUREG-0650, "Preparing NUREG-Series Publications," Rev. 2 (January 1999), will remain the same with one exception. You will no longer be required to include the NUREG-series designator on the bottom of each page of the manuscript. The NRC will assign this designator when we send the camera-ready copy to the printer and will place the designator on the cover, title page, and spine. The designator for each report will no longer be assigned when the decision to prepare a publication is made. The NRC's Publishing Services Branch will inform the NRC Project Manager for the publication of the assigned designator when the final manuscript is sent to the printer.

For the electronic manuscript, the Contractor shall prepare the text in Microsoft Word, and use any of the following file types for charts, spreadsheets, and the like.

File Types to be Used for NUREG-Series Publications	
File Type	File Extension
Microsoft®Word®	.doc
Microsoft® PowerPoint®	.ppt
Microsoft®Excel	.xls
Microsoft®Access	.mdb
Portable Document Format	.pdf

This list is subject to change if new software packages come into common use at NRC or by our licensees or other stakeholders that participate in the electronic submission process. If a portion of your manuscript is from another source and you cannot obtain an acceptable electronic file type for this portion (e.g., an appendix from an old publication), the NRC can, if necessary, create a tagged image file format (file extension.tif) for that portion of your report. Note that you should continue to submit original photographs, which will be scanned, since digitized photographs do not print well.

If you choose to publish a compact disk (CD) of your publication, place on the CD copies of the manuscript in both (1) a portable document format (PDF); (2) a Microsoft Word file format, and (3) an Adobe Acrobat Reader, or, alternatively, print instructions for obtaining a free copy of Adobe Acrobat Reader on the back cover insert of the jewel box.