

<b>INTERAGENCY AGREEMENT</b>		1 IAA NO NRC-HQ-60-13-D-0023/M0006	PAGE 1	OF 2
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2 ORDER NO	3 REQUISITION NO	4 SOLICITATION NO
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5 EFFECTIVE DATE 07/17/2015	6 AWARD DATE 07/17/2015	7 PERIOD OF PERFORMANCE 09/23/2013 TO 06/30/2016
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5 SERVICING AGENCY ARGONNE NATIONAL LAB ALC: DUNS: +4: US DEPARTMENT OF ENERGY 9800 SOUTH CASS AVENUE LEMONT IL 60439  POC Sean Seamon TELEPHONE NO 630-252-2077	9 DELIVER TO APPAJOSULA RAO US NUCLEAR REGULATORY COMMISSION TWO WHITE FLINT NORTH BUILDING 11545 ROCKVILLE PIKE MAIL STOP T-10A36 ROCKVILLE MD 20852
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10 REQUESTING AGENCY ACQUISITION MANAGEMENT DIVISION ALC: 3100001 DUNS: 040535809 +4: US NUCLEAR REGULATORY COMMISSION TWO WHITE FLINT NORTH 11545 ROCKVILLE PIKE MAIL STOP T-5E3 ROCKVILLE MD 20852-2738 POC Carolyn A. Cooper TELEPHONE NO 301-415-6734	11 INVOICE OFFICE US NUCLEAR REGULATORY COMMISSION ONE WHITE FLINT NORTH 11555 ROCKVILLE PIKE MAILSTOP O3-E17A ROCKVILLE MD 20852-2738
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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 V6455
	15 PROJECT TITLE GAP ANALYSIS FOR IRRADIATION AND THERMAL EFFECTS

16 ACCOUNTING DATA N/A
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17 ITEM NO	18 SUPPLIES/SERVICES	19 QUANTITY	20 UNIT	21 UNIT PRICE	22 AMOUNT
	NRC-HQ-60-13-D-0023 Master IAA: N/A The purpose of this modification is to incorporate a within scope change to the statement of work (Attachment 1), thereby increasing the agreement ceiling amount by \$111,979.00 and extending the period of performance to June 30, 2016.  Accordingly, the agreement is hereby modified:  The agreement ceiling amount is increased by Continued ...				

23 PAYMENT PROVISIONS	24 TOTAL AMOUNT \$0.00
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25a SIGNATURE OF GOVERNMENT REPRESENTATIVE (SERVICING) <i>Sean Seamon</i>	26a SIGNATURE OF GOVERNMENT REPRESENTATIVE (REQUESTING) <i>Carolyn A. Cooper</i>
25b NAME AND TITLE Sean Seamon, Contracting Officer	26b CONTRACTING OFFICER CAROLYN A. COOPER
25c DATE 8/13/15	26c DATE 7/17/2015

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\$111,979.00, from \$287,205.00 to \$399,184.00 and the agreement period of performance is extended from December 31, 2015 to June 30, 2016.

AMOUNT OF THIS ACTION: \$111,979.00  
TOTAL CEILING AMOUNT: \$399,184.00 (changed)  
TOTAL FUNDING AMOUNT: \$287,205.00 (unchanged)

The following document is hereby made part of this Agreement: Attachment 1, Statement of Work.

All other terms and conditions of the subject agreement remain unchanged.

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

**STATEMENT OF WORK**

NRC Agreement Number	NRC Agreement Modification Number	NRC Task Order Number (If Applicable)	NRC Task Order Modification Number (If Applicable)
NRCHQ-60-13-D-0023	M0006		
Project Title Gap Analysis for Irradiation and Thermal Effects in High Ferrite Cast Stainless Steel			
Job Code Number	B&R Number	DOE Laboratory	
V-6455		Argonne National Laboratory	
NRC Requisitioning Office RES			
NRC Form 187, Contract Security and Classification Requirements <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)	
Docket Number (If Fee-Recoverable/Applicable)		Inspection Report Number (If Fee Recoverable/Applicable) N/A	
Technical Assignment Control Number (If Fee-Recoverable/Applicable)		Technical Assignment Control Number Description (If Fee-Recoverable/Applicable)	

**1.0 BACKGROUND:**

This project was undertaken to review and revise the NUREG/CR-4513, Rev. 1 with the new fracture toughness J-R curve data for CF-3, CF-8, and CF-8M grades of CASS materials (containing up to 40% ferrite) in thermally aged and un-aged as well as neutron irradiated and un-irradiated conditions. In addition, the project was also intended to review, analyze and prepare a draft NUREG/CR or final technical letter report, documenting the relationship between the fracture toughness information for these steel welds and the heat-affected zone (HAZ) of these welds as a function of reactor service conditions.

When the present revision of NUREG/CR-4513, Rev. 1 was proposed, it was not anticipated that a lot more information would be available from France and Japan. Since then, some new results from the French, and some Japanese research effort data have been received. Therefore, a decision was made by RES technical staff to include all the data that is presently available into the present analysis document.

In addition, recently RES received reviewer's comments on a report on corrosion fatigue, and one of the comment being that this work is most important for both NRC and the industry. Therefore, RES technical staff would like the contractor to address all the comments and incorporate the responses in the corrosion fatigue document.

## **2.0 OBJECTIVE**

The objective of this modification is to (i) continue the review of NUREG/CR-4513, Rev.1 and update this NUREG/CR to Rev. 2, (ii) complete the preparation of the final letter report on steel welds and heat affected zone and (iii) review the corrosion fatigue document and reviewer's comments, and prepare a final report with all the responses incorporated into the document.

## **3.0 SCOPE OF WORK**

The scope of this modification is as follows:

In order to incorporate all the available new data into NUREG/CR. Rev. 2, some of the plots shall be redrawn. In addition, some new sections and the discussion section shall be rewritten.

In addition, a new task is being added via this modification. The new task is to review and address the reviewer's comments on the corrosion fatigue report and prepare a technical letter report. The details are provided below:

New Task: (5)

- NRC staff will provide the contractor corrosion fatigue document, the reviewer's comments and NRC Staff comments. After the receipt of the comments, the contractor shall address all the reviewer's and NRC staff comments.
- The contractor then shall prepare a technical report documenting both the comments and the responses to the comments.
- Following the NRC staff approval of the contractor responses to the reviewer comments, the contractor shall revise the corrosion fatigue report and incorporate all the responses.
- The contractor shall prepare a technical letter report and submit it to the COR who in cooperation with RES staff will review and make recommendations and submit the final technical letter report to NRC staff.

## **4.0 SPECIFIC TASKS**

### Task 1. DATA COLLECTION

The DOE Laboratory shall collect and review all the available data on the CGR and FT for both un-irradiated and irradiated CASS with broad range of ferrite. The work shall evaluate FT and CGR data as well as the combined thermal embrittlement (TE) and neutron irradiation embrittlement (IE) effects on FT and CGR data. The study shall encompass cast stainless steels with ferrite content extending beyond 25%. Similar information shall be assembled for thermally aged flux welds.

Task 2. PERPARE DRAFT NUREG/CR

The DOE Laboratory shall perform the following tasks:

- Prepare draft NUREG/CR documenting the relationship between ferrite content and crack growth rate and fracture toughness information for all CASS steels and weld metals both in aged and un-aged condition.
- Prepare manuscript for submission to peer reviewed scientific journal (viz. Journal of Nuclear materials or Journal of Pressure Vessel Technology) from the final gap analysis (Task 1)

Task 3. REVIEW/REVISE NUREG/CR 4513 REV. 1

The DOE Laboratory shall perform the following tasks:

- Review and revise the NUREG/CR-4513, Rev. 1 with the new fracture toughness J-R curve data for CF-3, CF-8, and CF-8M grades of CASS materials (containing up to 40% ferrite) in thermally aged and unaged as well as neutron irradiated and un-irradiated conditions.
- Prepare draft NUREG/CR-4513, Rev. 2 to incorporate the following; (a) update the methodology for estimating thermal embrittlement of various grades of CASS materials as a function of time and temperature of reactor service, and (b) discuss the procedure for estimating the effects of neutron irradiation on fracture toughness of these materials, including the combined effects of thermal and neutron embrittlement.

Task 4 REVIEW DATA ON SS AUSTENITIC WELDS

- Review the data on austenitic SS welds and their processing, and fracture toughness, in neutron irradiated and un-irradiated and thermally aged and unaged conditions. Prepare a draft NUREG/CR report, documenting the relationship between the fracture toughness information for these welds and heat-affected zone (HAZ) as a function of reactor service.

Tasks 3 - 4:

- Continue the preparation and submission of all the deliverables for Tasks 3 and 4

Task: 5 PREPARE TECHNICAL LETTER REPORT

- NRC staff will provide the contractor corrosion fatigue document, the reviewer's comments and NRC Staff comments. After the receipt of the comments, the contractor shall address all the reviewer's and NRC staff comments.
- The contractor then shall prepare a technical report documenting both the comments and the responses to the comments.
- Following the NRC staff approval of the contractor responses to the reviewer comments, the contractor shall revise the corrosion fatigue report and incorporate all the responses.

- The contractor shall prepare a technical letter report and submit it to the COR who in cooperation with RES staff will review and make recommendations and submit the final technical letter report to NRC staff.

## 5.0 DELIVERABLES AND/OR MILESTONES SCHEDULE

<u>Task #</u>	<u>Deliverable</u>	<u>Due Date</u>
3	Draft NUREG/CR-4513, Rev. 2	12/31/2015
3	Final NUREG/CR-4513, Rev. 2	6/15/2016
4	Draft NUREG/CR/Final TLR on Welds and HAZ	12/31/2015
4	Final NUREG/CR/Final TLR on Welds and HAZ	6/15/2016
5	Responses to the reviewer's comments on corrosion fatigue report	12/31/2015
5	Technical letter report with all the responses incorporated / changes to the corrosion fatigue report made will be submitted to NRC	6/15/2016

## 6.0 TECHNICAL AND OTHER SPECIAL QUALIFICATIONS REQUIRED

No Change

## 7.0 MEETINGS AND TRAVEL

Travel for this modification is for one technical staff to travel to conference or visit NRC for technical presentation for 2 days.

## 8.0 REPORTING REQUIREMENTS

No Change

## 9.0 PERIOD OF PERFORMANCE

Period of performance is from September 23, 2013 through June 30, 2016.

## 10.0 CONTRACTING OFFICER'S REPRESENTATIVE

No Change

## 11.0 MATERIALS REQUIRED

No Change.

**12.0 NRC-FURNISHED PROPERTY/MATERIALS**

No Change

**13.0 RESEARCH QUALITY**

No Change

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

No Change

**15.0 OTHER CONSIDERATIONS:**

No Change