

**ORDER FOR SUPPLIES OR SERVICES**

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1 7

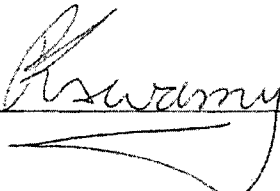
IMPORTANT: Mark all packages and papers with contract and/or order numbers.

BPA NO. NRC-DR-04-08-147

1. DATE OF ORDER <b>AUG 31 2009</b>		2. CONTRACT NO. (if any) GS10F0145T		6. SHIP TO:	
3. ORDER NO. NRC-T003		4. REQUISITION/REFERENCE NO. 04-08-147T003		a. NAME OF CONSIGNEE U.S. Nuclear Regulatory Commission	
5. ISSUING OFFICE (Address correspondence to) U.S. Nuclear Regulatory Commission Div. of Contracts Attn: Adelis M Rodriguez, 301-492-3523 Mail Stop: TWB-01-B10M Washington, DC 20555				b. STREET ADDRESS Mail Stop: C-C07M ATTN: Eric Focht	
7. TO:		c. CITY Washington		d. STATE DC	e. ZIP CODE 20555
a. NAME OF CONTRACTOR ENGINEERING MECHANICS CORPORATION OF COLUMBUS EMC2				i. SHIP VIA	
b. COMPANY NAME				B. TYPE OF ORDER	
c. STREET ADDRESS 3518 RIVERSIDE DR STE 202				<input type="checkbox"/> a. PURCHASE <input checked="" type="checkbox"/> b. DELIVERY REFERENCE YOUR _____ Please furnish the following on the terms and conditions specified on both sides of this order and on the attached sheet, if any, including delivery as indicated. Except for billing instructions on the reverse, this delivery order is subject to instructions contained on this side only of this form and is issued subject to the terms and conditions of the above-numbered contract.	
d. CITY COLUMBUS		e. STATE OH	f. ZIP CODE 432211735		
9. ACCOUNTING AND APPROPRIATION DATA Obligate \$90,000.00 B&R: 960-15-111-123 JOB: N6637 BOC: 252A 31X0200.960 FPS: RES-C09-590 DUNS: 014083161				10. REQUISITIONING OFFICE RFS	

11. BUSINESS CLASSIFICATION (Check appropriate box(es))					12. F.O.B. POINT Destination
<input checked="" type="checkbox"/> a. SMALL	<input type="checkbox"/> b. OTHER THAN SMALL	<input type="checkbox"/> c. DISADVANTAGED	<input type="checkbox"/> g. SERVICE-DISABLED VETERAN-OWNED		
<input type="checkbox"/> d. WOMEN-OWNED	<input type="checkbox"/> e. HUBZone	<input type="checkbox"/> f. EMERGING SMALL BUSINESS			
13. PLACE OF		14. GOVERNMENT B/L NO.	15. DELIVER TO F.O.B. POINT ON OR BEFORE (Date)		16. DISCOUNT TERMS
a. INSPECTION destination		b. ACCEPTANCE destination			

17. SCHEDULE (See reverse for Rejections)

ITEM NO. (a)	SUPPLIES OR SERVICES (b)	QUANTITY ORDERED (c)	UNIT (d)	UNIT PRICE (e)	AMOUNT (f)	QUANTITY ACCEPTED (g)
	The contractor shall perform the services as described in the attached statement of work in accordance with the price schedule in section A.1 and the terms and conditions of BPA NRC-DR-04-08-147.  Order Type: Labor Hour Period of Performance: Award date- 8/19/2011 Total Order Ceiling: \$206,035.00 Total Obligated Amount: \$90,000.00  Accepted:  8/31/09 Date					

18. SHIPPING POINT		19. GROSS SHIPPING WEIGHT		20. INVOICE NO.	
21. MAIL INVOICE TO:					
a. NAME Department of Interior / NBC NRCPayments@nbc.gov					
b. STREET ADDRESS (or P.O. Box) Attn: Fiscal Services Branch - D2770 7301 W. Mansfield Avenue					
c. CITY Denver		d. STATE CO	e. ZIP CODE 80235-2230		

22. UNITED STATES OF AMERICA BY (Signature) 		23. NAME (Typed) Stephen Pool Contracting Officer TITLE: CONTRACTING/ORDERING OFFICER	
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OPTIONAL FORM 347 (REV. 4/2006)  
PRESCRIBED BY GSA/FAR 48 CFR 53.211-6

**SUNSI REVIEW COMPLETE**      **AUG 31 2009**

TEMPLATE - ADM001

ADM002

**TASK ORDER TERMS AND CONDITIONS**

**A.1 PRICE SCHEDULE**

Labor Category	Labor Rate	Est. Hours	Total
President	[REDACTED]	0	\$0.00
Vice-President	[REDACTED]	0	\$0.00
Senior Program Manager	[REDACTED]	[REDACTED]	\$52,893.00
Senior Regulatory Advisor	[REDACTED]	0	\$0.00
Senior Research Leader	[REDACTED]	[REDACTED]	\$100,750.00
Research Leader	[REDACTED]	0	\$0.00
Principal Engineer	[REDACTED]	[REDACTED]	\$52,392.00
Research Engineer	[REDACTED]	0	\$0.00
Engineer	[REDACTED]	0	\$0.00
Master Technician	[REDACTED]	0	\$0.00
Electronics Specialist	[REDACTED]	0	\$0.00
Administrative assist.	[REDACTED]	0	\$0.00
			\$0.00
ODC – Cost reimbursement. No G&A or Materials and handling charges are applicable.			\$0.00
Travel - Cost reimbursement. No G&A or Materials and handling charges are applicable.			\$0.00
<b>Total</b>			<b>\$206,035.00</b>

**A.2 CONSIDERATION AND OBLIGATION - LABOR HOUR ORDER**

(a) The total not to exceed cost to the Government for full performance of this contract is \$206,035.00.

(b) The amount currently obligated by the Government with respect to this contract is \$90,000. The contractor shall not exceed this obligated amount at any time.

STATEMENT OF WORK  
FOR CONTRACTOR TO PROVIDE  
BOUNDARY INTEGRITY ANALYSES AND SUPPORT:  
FRACTURE MECHANICS ANALYSES  
OF DISSIMILAR METAL WELDS

I. BACKGROUND

Boundary integrity analyses are required to conduct safety assessments of nuclear reactor coolant pressure boundary (RCPB) components, including the reactor pressure vessel (RPV), and to develop technical bases for regulatory positions. Nickel-base alloys are used extensively in RCPB components, along with their corresponding weld metals, and have been the focus of leak-before-break analyses due to cracking associated with primary water stress corrosion cracking (PWSCC). The occurrences of cracking have been identified through various means, including the discovery of boric acid deposits resulting from through-wall cracking in the primary system pressure boundary. PWSCC in nickel-based alloy RCS components is a safety concern due to the potential for reactor pressure boundary leaks and the associated potential of boric acid corrosion of low alloy steels and the development of flaws in piping or welds. Either condition, depending on the size and location of the flaws, could result in a loss of coolant accident.

PWSCC of nickel-base alloys in RCS components has been documented in both foreign and domestic plants and has been typically identified by the build-up of boric acid deposits in the vicinity of the cracked components. The industry response to addressing PSWCC is coordinated through the Materials Reliability Program (MRP) in a comprehensive, multifaceted effort. Although the industry program is addressing many of the issues raised by these cracking occurrences, the Office of Nuclear Reactor Regulation (NRR) has identified several issues requiring additional consideration regarding the generic implications of these events. In a memorandum dated June 5, 2001, NRR provided a user need request (NRR-2002-018) to the Office of Nuclear Regulatory Research (RES) to evaluate issues involving cracking in Alloy 82/182 welds and Alloy 600 base metal at several domestic and overseas plants. An updated user need request, NRR-2006-006, supersedes NRR-2002-018 and identifies NRR's current needs in the area of PWSCC of nickel-base alloy primary pressure boundary components. A research effort is currently underway in RES to address the specific needs outlined in NRR-2006-006. During that effort, several ASME Code-related issues arose that were outside of the scope of the contract and need to be addressed under a separate contract.

II. OBJECTIVE

The objective of this project is to provide technical analytical support to NRR to develop the technical basis for future regulatory decisions related to enhanced component integrity analysis of light water reactor components.

III. SCOPE OF WORK

The contractor shall perform work related to fracture mechanics analyses of dissimilar metal welds to include probabilistic fracture mechanic analysis, probabilistic fracture mechanic analysis technical assistance and technical assistance on the development of XLPR code.

IV. REQUIREMENTS

**Task 3: Fracture Mechanics Analyses of Dissimilar Metal Welds**

Task 3a: Probabilistic Fracture Mechanics Analysis: Using the probabilistic analysis models developed under Task 3 of the Component Integrity Program, assess the risk of failure and leakage caused by PWSCC of nickel-base alloys in reactor pressure boundary components, i.e., RPVH penetration nozzles and butt welds, for conditions specified by the NRC.

Deliverable: Provide a technical letter report to the NRC program officer.  
Deliverable due date: within 18 months of task initiation.

Task 3b: Probabilistic Fracture Mechanics Analysis Technical Assistance: Provide technical assistance to the NRC staff to: Review pertinent industry reports, guidelines, and licensee submittals related to probabilistic fracture mechanics modeling. Assess MRP work in these areas, including base assumptions, computer codes used, and operational experience. This assistance may require participation in meetings and on conference calls.

Task 3c: Technical Assistance on the Development of xLPR Code: Provide technical assistance to the NRC staff through knowledge transfer of existing models dealing with crack stability, crack growth, leakage through cracks, and material properties and developing appropriate values, including either fixed or mean, standard deviation and distribution where appropriate, of the following quantities for a PWR pressurizer surge nozzle dissimilar weld: probabilistic fracture mechanics modeling. Assess MRP work in these areas, including base assumptions, computer codes used, and operational experience. This assistance may require participation in meetings and on conference calls

V. PERIOD OF PERFORMANCE

The period of performance of this task order is from award date to August 19, 2011.

VI. RESEARCH QUALITY

The quality of NRC research programs are assessed each year by the Advisory Committee on Reactor Safeguards. Within the context of their reviews of RES programs, the definition of quality research is based upon several major characteristics:

Results meet the objectives (75% of overall score)  
Justification of major assumptions (12%)  
Soundness of technical approach and results (52%)  
Uncertainties and sensitivities addressed (11%)

Documentation of research results and methods is adequate (25% of overall score)  
Clarity of presentation (16%)  
Identification of major assumptions (9%)

It is the responsibility of the contractor to ensure that these quality criteria are adequately addressed throughout the course of the research that is performed. The NRC project Officer and technical monitor will review all research products with these criteria in mind.

VII. TECHNICAL AND OTHER SPECIAL QUALIFICATIONS REQUIRED

The program manager, key personnel, and any other senior technical staff performing work under this contract shall have expertise, experience, and/or education in the following key areas:

- a) Expertise in finite element analyses;
- b) Expertise in mechanical properties testing and measurement techniques
- c) Expertise in developing fracture mechanics codes;
- d) Expertise in leakage detection technologies and leak-rate predictive codes;
- e) Detailed knowledge of DM weld fabrication methods;
- f) Detailed knowledge of industry and NRC staff analyses regarding reported occurrences of DM weld cracking and NRC actions (e.g., notices, bulletins);
- g) Knowledge of NRC regulatory process as it relates to DM weld cracking.

VIII. PUBLICATIONS NOTE

RES encourages the publication of the scientific results from RES sponsored programs in refereed scientific and engineering journals as appropriate. If the laboratory proposes to publish in the open literature or present the information at meeting in addition to submitting the required technical reports, approval of the proposed article or presentation should be obtained from the NRC Project Officer. The RES Project officer shall either approve the material as submitted, approve it subject to NRC suggested revisions, or disapprove it. In any event, the RES Project Officer may disapprove or delay presentation or publication of papers on information that is subject to Commission approval that has not been ruled upon or which has been disapproved. Additional information regarding the publication of NRC sponsored research is contained in

NRC Management Directives 3.7, "NUREG Series Publications," and 3.9, "NRC Staff and Contractor Speeches, Papers, and Journal Articles on Regulatory and Technical Subjects."

If the presentation or paper is in addition to the required technical reports and the RES Project Officer determines that it will benefit the RES project, the Project Officer may authorize payment of travel and publishing costs, if any, from the project funds. If the Project Officer determines that the article or presentation would not benefit the RES project, the costs associated with the preparation, presentation, or publication will be borne by the contractor. For any publication or presentations falling into this category, the NRC reserves the right to require that such presentation or publication will not identify the NRC's sponsorship of the work.

IX. NEW 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 Officer in both electronic and camera-ready copy.

All format guidance, as specified in NUREG-0650, Revision 2, 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 Officer 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

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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.