AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

1. CONTRACT ID CODE	PAGE	OF PAGES
	1	2

2. AMENDMENT/MODIFICATION NO.	3. EFFECTIVE DATE	4. REQUISITION/PURCHASE REQ. NO.	5. PROJECT NO. (If applicable)
2	JUL 2 ? 2002	RES-02-062; 5/30/02	

6. ISSUED BY	CODE	7. ADMINISTERED BY (If other than Item 6)	CODE
U.S. Nuclear Regulatory Commission Div of Contracts and Property Mgmt Two White Flint North - MS T-7-I-2 Washington, DC 20555		U.S. Nuclear Regulatory Commission Div of Contracts and Property Mgmt Two White Flint North - MS T-7-I-2 Washington, DC 20555	

8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)	(X)	9A. AMENDMENT OF SOLICITATION NO.
Engineering Mechanics Corp. of Columbus 3518 Riverside Drive Suite 202 Columbus OH 43221-1735		9B. DATED (SEE ITEM 11)
		10A. MODIFICATION OF CONTRACT/ORDER NO. NRC-04-02-062
CODE / FACILITY CODE	X	10B. DATED (SEE ITEM 13) 01-07-2002

11. THIS ITEM ONLY APPLIES TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in Item 14. The hour and date specified for receipt of Offers ☐ is extended, ☐ is not extended.
Offers must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation or as amended, by one of the following methods:
(a) By completing Items 8 and 15, and returning _____ copies of the amendment; (b) By acknowledging receipt of this amendment of each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE PLACE DESIGNATED FOR THE RECEIPT OF OFFERS PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

12. ACCOUNTING AND APPROPRIATION DATA (If required)
B&R No.: 26015110191 Job Code: Y6453 BOC: 252A
APPN No.: 31X0200.260 RES ID#: RES-02-431 Obl. Amt. $70,000

13. THIS ITEM APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS, IT MODIFIES THE CONTRACT/ORDER NO. AS DESCRIBED IN ITEM 14.

(X)	
	A. THIS CHANGE ORDER IS ISSUED PURSUANT TO: (Specify authority) THE CHANGES SET FORTH IN ITEM 14 ARE MADE IN THE CONTRACT ORDER NO. IN ITEM 10A.
X	Changes Clause 52.243-2
	B. THE ABOVE NUMBERED CONTRACT/ORDER IS MODIFIED TO REFLECT THE ADMINISTRATIVE CHANGES (such as changes in paying office, appropriation date, etc.) SET FORTH IN ITEM 14, PURSUANT TO THE AUTHORITY OF FAR 43.103(b).
	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF:
	D. OTHER (Specify type of modification and authority)

E. IMPORTANT: Contractor ☐ is not, ☒ is required to sign this document and return 2 copies to the issuing office.

14. DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.)

See attached page.

Except as provided herein, all terms and conditions of the document referenced in Item 9A or 10A, as heretofore changed, remains unchanged and in full force and effect.

15A. NAME AND TITLE OF SIGNER (Type or print)	16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print)
Gary M. Wilkowski President	for Mary H. Mace Contracting Officer
15B. CONTRACTOR/OFFEROR (Signature of person authorized to sign)	15C. DATE SIGNED: 7/24/02
16B. UNITED STATES OF AMERICA BY (Signature of Contracting Officer)	16C. DATE SIGNED: 7/23/02

STANDARD FORM 30 (REV. 10-83)

ADM02

TEMPLATE - ADM001

NRC-04-02-062
Modification No. 2

The purpose of this modification is to: (1) modify the contract to include work required at Davis-Besse as described in the attached statement of work, (2) increase the contract ceiling and obligated amounts by $70,000 from $231,257 to $301,257, and (3) extend the period of performance for tasks 2 and 3 under the original statement of work through December 31, 2002 at no additional cost or obligation to the Government. Accordingly, the contract is hereby revised accordingly:

1. The contractor shall perform the work described in the attached Statement of Work.

2. Under Section B.3, Consideration and Obligation–Cost Plus Fixed Fee, paragraphs a, c, and d are revised as follows:

   "(a) The total estimated cost to the Government for full performance of this contract is $301,257, of which the sum of $277,656 represents the estimated reimbursable costs, and the amount of $23,601 represents the fixed fee.

   (c) The amount currently obligated by the Government with respect to this contract is $301,257.

   (d) It is estimated that the amount currently allotted will cover performance through December 31, 2002."

3. The period of performance for Task 2 and 3 under the original statement of work is extended through December 31, 2002. All work under Task 1 has been completed.

A summary of obligations, from the award date through the date of this modification are provided below:

FY 02 Obligations: $301,257.00

Cumulative Obligations: $301,257.00

This modification obligates FY 02 funds in the amount of $70,000.

STATEMENT OF WORK
MODIFICATION NO. 2

TITLE: CRDM CRACKING

I. INTRODUCTION

Cracking in the Control Rod Drive Mechanism (CRDM) nozzles and seal welds at Oconee Nuclear Station was first noted on Unit 1 when small amounts of boron residue was found on the top of the reactor pressure vessel (RPV) head in November 2000, during a refueling outage inspection. Similar problems were found on Unit 3 in February 2001, during a planned maintenance outage, and on Unit 2 in May 2001, during a refueling outage. Subsequent examinations of the CRDM nozzles with boron residue found through-wall axial cracking in these nozzles, and through-wall circumferential cracking above the weld in two of nozzles in Unit 3, and in one nozzle in Unit 2. Since April 2001, the NRC staff has held a series of public meetings with the industry at NRC Headquarters to discuss circumferential cracking of CRDM nozzles.

On August 3, 2001, the NRC issued Bulletin 2001-01, "Circumferential Cracking of Reactor Pressure Vessel Head Penetration Nozzles." The bulletin requested information from the licensees of 69 pressurized water reactors (PWRs) regarding the structural integrity of their nuclear reactor RPV head penetrations. Because of the potentially serious consequences of the cracking and questions relative to the continued safe operation of these nuclear power plants, an urgent sole source purchase order was placed on June 22, 2001, for Engineering Mechanics Corporation of Columbus (Emc^2) to perform an independent evaluation of industry submittals relative to circumferential cracking of reactor pressure vessel head penetration nozzles (Purchase Order no. DR-01-0106, "Control Rod Drive Mechanism Cracking"). Emc^2 had previously performed work for the NRC relative to cracking in Alloy 600 piping. Because of the similarities in materials and cracking mechanism (primary water stress corrosion cracking [PWSCC]), Emc^2 was requested to review industry submittals relative to CRDM cracking and assess whether nuclear power plant detection systems are adequate for detecting the type and size cracks that were reported in CRDM nozzles. In addition, as required, Emc^2 would provide expertise and assessments relative to: additional industry submittals, NRC staff analyses, and meetings with the NRC Advisory Committee on Reactor Safeguards (ACRS).

As plants began their scheduled inservice inspections in the fall of 2001 and examined CRDM nozzles in response to the bulletin, an alarming number of reports of additional nozzle cracking were received by the NRC staff. To date, 15 pressurized water reactors (PWRs) have reported 69 cracked CRDM nozzles. On January 2, 2002, a contract was awarded to Emc^2 to develop an improved probabilistic model for performing time to failure from leakage relative to circumferential crack evaluations in CRDMs (NRC-04-02-062). The Emc^2 effort will provide some of the analyses required by the NRC staff to adequately disposition industry responses to the bulletin and to predict the service life of CRDMs for operating reactors.

On February 16, 2002, the Davis-Besse Nuclear Power Station in Oak Harbor, Ohio, began a refueling outage that included inspecting the CRDM nozzles (consistent with the licensee's commitments in response to NRC Bulletin 2001-01). In conducting its inspections, the licensee found that three CRDM nozzles had indications of axial cracking, which had resulted in leakage of the reactor's pressure boundary. On March 6, 2002, during the repair process, the licensee

found indications of material wastage of the head of the RPV. The wastage area was found to extend approximately 5 inches downhill on the RPV head from the penetration for CRDM nozzle 3 and was approximately 4 to 5 inches at its widest part. In addition, the boric acid had consumed the RPV head down to the stainless steel cladding on the inside surface of the RPV head.

On March 7, 2002, the Office of Nuclear Reactor Regulation (NRR) requested additional support from the Office of Nuclear Regulatory Research (RES) to assess the causes and consequences of the RPV head wastage. Due to the serious nature of the occurrence, the assessment had to be initiated very quickly. On March 7, 2002, RES requested Emc^2 to assist in the Davis-Besse assessment (the head wastage issue is directly related to the tasks in the original statement of work (CRDM cracking)).

II. OBJECTIVE

This modification to the statement of work addresses the additional tasks necessitated by head wastage at Davis-Besse.

III. SCOPE OF WORK

Estimate the margins that existed for the cladding in the Davis-Besse head. Calculate the margins on the calculated "failure pressure" to the operating pressure as well as the amount of additional corrosion that would have been required for failure at the normal operating pressure.

The contractor shall:

(A) Assess the cladding failure pressure in the corroded area using 2-dimensional finite element analysis procedures. The industry analysis assumed that failure would occur in the cladding once it reached the true strain that corresponds to the ultimate strength from uniaxial tensile test data of cladding weld metal at 600°F. [Work Completed]

(B) Assess the industry's failure criterion assumption and recommend a best-estimate failure criterion. [Completed]

(C) Compare their calculated failure pressures with the industry analysis and the preliminary 3-D analyses being performed at Oak Ride National Laboratory (ORNL). [Work Completed]

(D) Oak Ridge National Laboratory (ORNL) has completed an interim 3-D analysis based on the latest available information. The industry has recently performed some additional analyses (e.g., dental impression of RPV head wastage). ORNL will perform a final 3-D analysis when the results from these additional tests become available. The final ORNL will be publicly released, and the industry will respond to ORNL's conclusions since it is expected that some of the ORNL conclusions will contradict or not confirm the industry's assumptions and results. The contractor will compare the industry response and the ORNL final 3-D analyses.

Deliverable: The contractor's written conclusions shall be provided to the NRC Project Officer by November 30, 2002.

(E) Make recommendations regarding additional efforts that may be required (e.g., performing tests to address major uncertainties of analyses, additional occurrences of degradation, new discoveries).

Deliverable: A report shall be submitted to the NRC Project Officer by December 31, 2002.

Coordination with ORNL and Argonne National Laboratory is required.

Level of Effort

A total estimated level of effort for work related to Davis Besse is 515 hours. The period of performance is March 7, 2002, through December 31, 2002.

IV. MEETINGS AND TRAVEL REQUIREMENTS

One trip in addition to those in the original statement of work to NRC Headquarters in Rockville, Maryland for two days shall be required at a date to be determined to meet with the ACRS.

V. PUBLICATIONS

RES encourages the publication of the scientific results from RES sponsored programs in refereed scientific and engineering journals as appropriate. If the contractor proposes to publish in the open literature or present the information at meetings in addition to submitting the required technical reports, approval of the proposed article or presentation shall be obtained from the NRC Project Officer.