

2. AMENDMENT/MODIFICATION NO. M001	3. EFFECTIVE DATE See Block 16c	4. REQUISITION/PURCHASE REQ. NO. RES-06-046/FFS: RES-C06-635	5. PROJECT NO. (if applicable)
6. ISSUED BY U.S. Nuclear Regulatory Commission Div of Contracts Two White Flint North - MS T-7-I-2 Washington, DC 20555	CODE 3100	7. ADMINISTERED BY (if other than Item 6) U.S. Nuclear Regulatory Commission Div of Contracts Two White Flint North - MS T-7-I-2 Washington, DC 20555	CODE 3100

8. NAME AND ADDRESS OF CONTRACTOR (No., street, county, State and ZIP Code)  SOUTHWEST RESEARCH INSTITUTE INC  6220 CULEBRA RD  SAN ANTONIO TX 782385100  CODE 007936842 FACILITY CODE	(X)	9A. AMENDMENT OF SOLICITATION NO.
		9B. DATED (SEE ITEM 11)
		10A. MODIFICATION OF CONTRACT/ORDER NO. DR-04-06-046
	X	10B. DATED (SEE ITEM 13) 06-02-2004

**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 on 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) N/A

**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.
	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).
X	C. THIS SUPPLEMENTAL AGREEMENT IS ENTERED INTO PURSUANT TO AUTHORITY OF: Mutual Agreement of Both Parties
	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 2.

DUNS: #007936842

15A. NAME AND TITLE OF SIGNER (Type or print) R. B. Kalmbach Director, Contracts		16A. NAME AND TITLE OF CONTRACTING OFFICER (Type or print) Valerie M. Whipple	
15B. CONTRACTOR/OFFEROR 	15C. DATE SIGNED 09/01/2006	16B. UNITED STATES OF AMERICA BY	16C. DATE SIGNED 8/17/06

The purpose of this modification is as follow:

1. To revise the Statement of Work to provide for a within scope change.
2. To delete FAR Clause 52.222-47 entitled "Service Contracts Act (SCA) Minimum Wages and Fringe Benefits."

Accordingly, the following changes are hereby made:

1. The Statement of Work is hereby replaced with the attached, revised Statement of Work dated June, 2006.
2. Section A.1. NOTICE LISTING CLAUSES INCORPRATED BY REFERENCE is revised to delete FAR Clause 52.222-47 entitled "Service Contracts Act (SCA) Minimum Wages and Fringe Benefits."

**All other terms and conditions under this purchase order remain unchanged.**

OFFICE OF NUCLEAR REGULATORY RESEARCH  
DIVISION OF FUEL, ENGINEERING, & RADIOLOGICAL RESEARCH  
MODIFIED STATEMENT OF WORK (June 2006)  
RES - 06-046

TITLE: GSI-191 PWR SUMP BLOCKAGE CHEMICAL EFFECTS THERMODYNAMIC SIMULATIONS -TECHNICAL ASSISTANCE TO NRC STAFF

BACKGROUND

As part of the resolution of generic safety issue (GSI) 191, the NRC is studying the performance of pressurized water reactor (PWR) sumps and the availability of water sources for emergency core cooling following a loss-of-coolant accident (LOCA) to ensure that emergency core cooling systems (ECCS) operate properly during potential accident scenarios. NRC's Advisory Committee on Reactor Safeguards (ACRS) during its review of staff activities raised a concern that corrosion products due to chemical interactions between the ECCS/containment spray water and exposed materials (such as metal surfaces, paint chips, and fiberglass insulation debris) could impede the performance of ECCS recirculation after a loss-of-coolant accident (LOCA) at a PWR plant. In response to this concern, the NRC's Office of Nuclear Regulatory Research (RES) sponsored an integrated chemical effects tests (ICET) program at the University of New Mexico, under the direction of Los Alamos National Laboratory. The ICET program was developed as a limited-scope suite of five different tests. Each test represents a unique containment pool environment and is intended to represent conditions applicable to a portion of the commercial PWR plants. The ICET program was conducted under a joint memorandum of understanding between the NRC Office of Nuclear Regulatory Research (RES) and the Electric Power Research Institute (EPRI) to address concerns about the possible deleterious impact from chemical reaction products on emergency core cooling system (ECCS) performance during recirculation following a hypothetical LOCA. The primary objectives for the ICET series were to (1) determine, characterize, and quantify chemical reaction products that may develop in the containment pool under a representative post-LOCA environment; and (2) determine and quantify any amorphous or gelatinous material that could be produced during the post-LOCA recirculation phase. The ICET results indicated that chemical products can form in representative sump environments and can potentially influence the sump head loss.

The NRC sponsored thermodynamic simulations at the Center for Nuclear Waste Regulatory Analyses (CNWRA) of certain chemicals and metals to gain information on potential chemical reactions and the effects of chemical reactions on the generation of debris and the effectiveness of post-LOCA coolant recirculation systems. In order to gain insights into important parameters and develop predictive capability of ICET results, a study was initiated at the CNWRA to perform thermodynamic simulations of chemical effects in a typical PWR post-LOCA containment environment. The results of CNWRA's thermodynamic simulations using a computer software OLI were summarized in NUREG/CR-6873. The report provided insights into important parameters and an understanding of the evolution of solution chemistry and the formation of solid phases in the ICET tests.

The CNWRA staff has assessed the usefulness of commercially available modeling software in simulating the formation of corrosion products from debris components and in their ability to provide useful insights into potential post-LOCA sump environment reactions during a

postulated LOCA event in a PWR. The CNWRA also evaluated the capability of commercially available modeling software to predict the environment generated in the ICET program and to determine limits of applicability of codes to allow an assessment of precipitate formation in plant specific environments that have not been explicitly tested as part the ICET program.

### OBJECTIVES

The objective of this modification to WORK is to provide technical assistance to the NRC staff in conducting safety reviews of licensees' responses to Generic Letter 2004-02. The scope includes providing technical assistance to NRC staff for predicting mass transfer reactions and chemical species formation under plant-specific conditions.

### SCOPE OF WORK

**(Modification Note: Tasks 1 & 2 listed below will not be performed. In lieu of tasks 1 & 2, work activities highlighted in Task 3 have been added.)**

#### Task 1: Develop User Manual/Guidance

In this task, CNWRA will develop, for NRC staff use, a computer program user manual and guidance specific to the modeling of the plant-specific conditions and interpreting results. The Manual will clearly identify any limitation of the modeling software and will also specify the applicable range of input parameters.

#### Task 2: Training of NRC staff

In this task, CNWRA will provide training for visiting NRC staff on the use of recommended software and in modeling of plant-specific conditions for thermodynamic simulation.

#### Task 3: Technical Assistance

In this task, CNWRA will provide technical assistance to NRC staff on as needed basis. The assistance includes but is not limited to additional evaluation of thermodynamic simulation software as required to enhance and address staff's comments on the draft NUREG/CR under preparation (Purchase order No. NRC-DR-04-05-067), participation in technical meetings, support in preparation of meetings with ACRS, participating in chemical effects peer review panel, and evaluation of any plant specific PWR environments.

**Additionally, CNWRA will examine Westinghouse Owners Group (WOG) report, 'Evaluation of Post-Accident Chemical Effects in Containment Sump Fluids to Support GSI-191', WCAP-16530-NP, Rev. 0, and perform limited confirmatory leaching tests with supporting analyses to verify important WCAP findings. CNWRA will also select and perform leaching testing on some of the other materials not tested in the WCAP report that are expected to differ substantially from tested materials. The scope of leaching tests and analyses will be concurred with the NRC staff.**

### PUBLICATION NOTE

RES encourages the publication of the scientific results from RES sponsored programs in referred scientific and engineering journals as appropriate. If CNWRA 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 RES Project Manager. The RES Project Manager shall either approve the material as submitted, approve it subject to NRC suggested revisions, or disapprove it. In any event, the RES Project Manager 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 3.8, "Unclassified Contractor and Grantee Publications in the NUREG Series," 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 Manager determines that it will benefit the RES project, the Project Manager may authorize payment of travel and publishing costs, if any, from the project funds. If the Project Manager 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 CNWRA. 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.

Reminder: An electronic version of camera-ready papers and draft and final versions of the paper shall be submitted to the NRC Project Manager with the paper versions.

### MEETINGS AND TRAVEL

All travel shall be approved by and coordinated with the NRC Project Manager. For the purpose of estimate, the project should assume four 3-days trips to NRC Headquarters (Rockville, MD) to provide technical assistance and brief the NRC Project Manager on the results.

### NRC FURNISHED MATERIALS

None.

### CNWRA ACQUIRED MATERIAL

None.

### DELIVERABLE/SCHEDULE AND/OR MILESTONES

Monthly Letter Status Report

A monthly letter status report (MLSR) will be submitted by the 20<sup>th</sup> of each month, for the previous month, to the NRC Project Manager, with copies to the Director, Division of Engineering Technology; Chief, Engineering Research Applications Branch; Chief, Mechanical and Structural Engineering Section, Engineering Research Applications Branch; and to the Division of Contracts, Office of Administration. Each MLSR will provide information in accordance with NRC Management Directive 11.7 Handbook, with the agreed upon capability of the CNWRA accounting system, including the title of the project, the JCN, the Principal Investigators, the period of performance, and the reporting period.

The MLSR will contain two sections as follows:

a) Project Status Section:

- (1) Objective: A brief statement of CNWRA's understanding of the objective of the program.
- (2) Progress During Reporting Period: A brief discussion and conclusion of efforts completed during the period, milestones reached, or if missed, and explanation provided. This will include all contacts made with industry during this period.
- (3) Travel: Travel taken during the reporting period will be described.
- (4) Anticipated and Encountered Problem Areas: Any problems or delays encountered or anticipated, and recommendations for resolution will be identified. (Note: if the recommended resolution involves a contract modification, i.e., change of work requirements level of effort (costs), or period of performance, a separate letter will be prepared and submitted to the NRC Project Manager).
- (5) Plans for Next Reporting Period: A brief summary of plans for the next reporting period, including work to be performed and anticipated travel. Milestones that will be completed will be described.
- (6) Variance: Any variance in either schedule or spending will be identified and discussed, including the cause and proposed solutions.

b) Financial Status Section:

- (1) Financial Status: CNWRA will provide a narrative description of the financial status of the project, including a discussion of the status of the projected cost and the schedule of the project. In addition, financial information will be provided in accordance with NRC Management Directive 11.7 within the agreed-upon capabilities of the CNWRA accounting system.
- (2) Spending Plan (SP) Update: Any required updates to the spending plan will be reported and discussed.

Major Milestones:

(Milestones for Tasks 1&2 have been deleted)

Technical Letter Report

The deliverable for Task 3 including WCAP-related work is a final technical letter report (TLR). The TLR shall summarize work performed under this task and an outline for the TLR shall be submitted to the NRC project manager for approval by August 15, 2006. The draft TLR shall be submitted by September 30, 2006, and the final TLR shall be completed by November 30, 2006.

Work performed under Task 3 to enhance and address staff's comments on the draft NUREG/CR will be included in a revised draft NUREG/CR. **The revised draft NUREG/CR shall be submitted to the NRC project manager by June 30, 2006 and final NUREG/CR shall be submitted four weeks after NRC comments are provided but no later than by August 31, 2006.**

NRC PROJECT OFFICER

B.P. Jain, RES, 301-415-6303  
Engineering Research Applications Branch  
Division of Engineering Technology  
Office of Nuclear Regulatory Research  
U.S. Nuclear Regulatory Commission  
Mail Stop: T-10D20

PERIOD OF PERFORMANCE

The period of performance is from 2/23/06 to 12/30/06.

LEVEL OF EFFORT

The estimated effort level is 0.3 staff-year.