



UNITED STATES
NUCLEAR REGULATORY COMMISSION

WASHINGTON, D.C. 20555-0001

APR 15 2002

Information Systems Laboratories, Inc.
ATTN: Mr. James F. Meyer
Vice President & Manager
11140 Rockville Pike, Suite 500
Rockville, MD 20852

Subject: TASK ORDER NO. 4, ENTITLED, "RESOLUTION OF COMMENTS REGARDING EVENT PROBABILITIES AND FREQUENCIES USED IN NUREG/CR-6395, 'ENHANCED PRIORITIZATION OF GENERIC SAFETY ISSUE 156.6.1 PIPE BREAK EFFECTS ON SYSTEMS AND COMPONENTS INSIDE CONTAINMENT'" UNDER CONTRACT NO. NRC-04-01-067

In accordance with Section G.4, Task Order Procedures, of the subject contract, this letter definitizes Task Order No. 4. This effort shall be performed in accordance with the enclosed Statement of Work.

Task Order No. 4 shall be in effect from April 15, 2002 through October 31, 2002, with a cost ceiling of \$32,135.00. The amount of \$29,893.00 represents the total estimated reimbursable cost, and the amount of \$2,242.00 represents the fixed fee.

Accounting data for this task order is as follows:

B&R No.: 26015110197
Job Code: Y6406
BOC Code: 252A
APPN No.: 31X0200.260
OBLIGATED AMOUNT: \$32,135.00

The following individuals are considered to be essential to the successful performance of the work hereunder:



The Contractor agrees that such personnel shall not be removed from the effort under the task order without compliance with Contract Clause H.1, Key Personnel.

The issuance of this task order does not amend any terms or conditions of the subject contract.

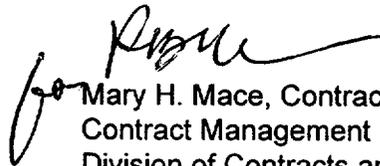
Your contacts during the course of this task are:

Technical Matters: Ronald Lloyd
Technical Monitor
(301) 415-7479

Contractual Matters: Anita Hughes
Contract Specialist
(301) 415-6526

Please indicate your acceptance of this task order by having an official who is authorized to bind your organization, execute three copies of this document in the spaces provided below and return two copies to the Contract Specialist. You should retain the third copy for your records. If you have any questions regarding the subject modification, please contact Anita Hughes, Contract Specialist on (301) 415-6526.

Sincerely,



Mary H. Mace, Contracting Officer
Contract Management Branch No. 1
Division of Contracts and Property Management
Office of Administration

Enclosure: As stated

ACCEPTED:

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NAME

TITLE

DATE


VP

4/18/02

STATEMENT OF WORK
Job Code Y6406; NRC CONTRACT No. NRC-04-01-067

CONTRACT TITLE: ASSESS AND IMPROVE REGULATORY EFFECTIVENESS

TASK ORDER 4 TITLE: Resolution of Comments Regarding Event Probabilities and Frequencies Used in NUREG/CR-6395, "Enhanced Prioritization of Generic Safety Issue 156.6.1 Pipe Break Effects on Systems and Components Inside Containment"

1.1 BACKGROUND

The U.S. Nuclear Regulatory Commission (NRC) is currently assessing the need to review the 41 older nuclear power plants referred to as the Systematic Evaluation Program Phase III (SEP-III) plants (see Table 1). Generic Safety Issue (GSI) 156.6.1 addresses whether the effects of pipe breaks inside containment have been adequately addressed in SEP-III plant designs. To give a basis for the prioritization of this GSI, a research program was performed to evaluate the degree of pipe protection in the SEP-III plants. These reviews were completed by the Idaho National Engineering and Environmental Laboratory (INEEL), and have been documented in NUREG/CR-6395, "Enhanced Prioritization of Generic Safety Issue 156.6.1 Pipe Break Effects on Systems and Components Inside Containment," which was issued in 1999. NUREG/CR-6395 used event frequencies and uncertainties for reactor coolant systems listed in NUREG-1150, "Severe Accident Risks: An Assessment for Five U.S. Nuclear Power Plants," which was published in 1990.

On November 15, 2001, the Boiling Water Reactor Owners' Group (BWROG) responded to the NRC with comments on the technical merits of NUREG/CR-6395, by issuing BWROG report NEDC-33054P, "Conservatism in NRC Prioritization of Pipe Break Effects on Systems and Components." The BWROG report claims that a number of assumptions employed in the NRC's analysis are overly conservative, and resulted in a "High" priority characterization when in fact GSI 156.6.1 should have received a "Low" or "Drop" priority.

Table 1: Systematic Evaluation Program Phase III (SEP-III) nuclear plants*			
Arkansas Nuclear One 1 (B&W)	Hatch 1 (GE)	<u>Oconee 3</u> (B&W)	Robinson 2 (W)
<u>Browns Ferry 1</u> (GE)	Indian Pt. 2 (W)	Peach Bottom 2 (GE)	Surry 1 (W)
<u>Browns Ferry 2</u> (GE)	Indian Pt. 3 (W)	Peach Bottom 3 (GE)	Surry 2 (W)
Brunswick 2 (GE)	Kewanee (W)	Pilgrim (GE)	Three Mile Island 1(B&W)
Calvert Cliffs 1 (CE)	Maine Yankee (CE)	Point Beach 1 (W)	Trojan (W)
Cooper (GE)	<u>Millstone 2</u> (CE)	Point Beach 2 (W)	Turkey Pt. 3 (W)
<u>D.C. Cook 1</u> (W)	Monticello (GE)	<u>Prairie Island 1</u> (W)	Turkey Pt. 4 (W)
Dresden 3 (GE)	<u>Nine Mile Pt. 1</u> (GE)	<u>Prairie Island 2</u> (W)	Vermont Yankee (GE)
Duane Arnold (GE)	<u>Oconee 1</u> (B&W)	Quad Cities 1 (GE)	Zion 1 (W)
<u>FitzPatrick</u> (GE)	<u>Oconee 2</u> (B&W)	Quad Cities 2 (GE)	Zion 2 (W)
<u>Fort Calhoun</u> (CE)			

*Updated Final Safety Analysis Reports were reviewed at underlined facilities as part of NUREG/CR-6395.

1.2 OBJECTIVE

Provide technical assistance to support the Division of Safety Assessment and Regulatory Effectiveness within the Office of Nuclear Regulatory Research, in the performance of its program to assess regulatory effectiveness in performance of generic safety issue assessment.

1.3 SCOPE

Task Order 4 - Resolution of Comments Regarding Event Probabilities and Frequencies Used in NUREG/CR-6395, "Enhanced Prioritization of Generic Safety Issue 156.6.1 Pipe Break Effects on Systems and Components Inside Containment"

1.3.1 The contractor will perform an analysis of technical comments made in the NEDC-33054P to determine their validity with respect to NUREG/CR-6395.

The BWROG report addresses two event types; (1) Type 1; a large high energy line break involving a pipe whip occurs that penetrates the primary containment and leads to failure of all emergency core cooling systems, and (2) Type 2; a large high energy line break involving a pipe whip or jet impingement occurs and results in failure of instrumentation and control (I&C), electrical, hydraulic or pneumatic lines, or components, and eventually resulting in failure of mitigation systems and core damage. NEDC-33054P lists six major concerns with NUREG/CR-6395. Those are discussed in their report in Sections 2 and 3 and summarized (for BWRs) in Table 2, "Core Damage Frequency [CDF] Assumptions." As a part of this Task Order, each concern will be reviewed, analyzed, and technically commented on as to its validity. A technical basis for rejection, modification, or acceptance of NEDC-33054P frequencies and probability values shall be provided for each concern.

(1) Pipe Break Frequency (/year)

- NUREG/CR-6395 lists a value of $1E-4$ /reactor-year for the pipe break frequency. This frequency value is used to calculate CDFs for BWR Events 1, 5, 9, 10, 12, 14, and 16.
- NUREG/CR-6395 lists the frequency of a high energy line break for a PWR as $1.5E-3$ /reactor-year. This frequency is used to calculate the CDF for PWR Event 9.
- NEDC-33054P proposes a pipe break frequency value of $1E-5$ /reactor-year.
- The contractor will provide a technical basis for rejection, modification, or acceptance of the NEDC-33054P proposed frequency.

(2) Containment Impact Probability

- NUREG/CR-6395 lists a containment impact probability of 0.25 for main steam and feedwater systems. This probability value is used to calculate the CDF for BWR Event 1.
- NUREG/CR-6395 lists a containment impact probability of 0.5 for the recirculation system. This probability value is used to calculate the CDF for BWR Event 9.

- NUREG/CR-6395 lists a containment impact probability of 0.5 for the residual heat removal system. This probability value is used to calculate the CDF for BWR Event 12.
- NEDC-33054P proposes a containment impact probability value of 0.05 for all piping systems postulated to break.
- The contractor will provide a technical basis for rejection, modification, or acceptance of the NEDC-33054P proposed probability. When considering containment impact, the contractor shall assess the likelihood of unrestrained impact, and the probability of more than one pipe impact.

(3) Containment Failure Probability Due to Impact

- NUREG/CR-6395 lists a containment failure probability of 0.25 for main steam and feedwater systems. This probability value is used to calculate the CDF for BWR Event 1.
- NUREG/CR-6395 lists a containment failure probability of 0.5 for the recirculation system. This probability value is used to calculate the CDF for BWR Event 9.
- NUREG/CR-6395 lists a containment failure probability of 0.1 for the residual heat removal system. This probability value is used to calculate the CDF for BWR Event 12.
- NEDC-33054P proposes a containment failure probability value of 0.01 for all piping systems postulated to break.
- The contractor will provide a technical basis for rejection, modification, or acceptance of NEDC-33054P proposed failure probability. When considering containment failure, the contractor shall assess the likelihood of unrestrained impact, and the probability of more than one pipe impact.

(4) Probability of Loss of All ECCS Assuming Containment Failure

- NUREG/CR-6395 lists a probability of 0.8 for a loss of all ECCS, assuming containment failure. This probability value is used to calculate CDFs for BWR Events 1, 9, and 12.
- NEDC-33054P proposes a probability value of 0.1.
- The contractor will provide a technical basis for rejection, modification, or acceptance of the NEDC-33054P proposed probability.

(5) Instrumentation and Control (I&C) Impact Probability

- NUREG/CR-6395 lists a value of 0.5 for the probability of impacting containment I&C systems. This probability value is used to calculate the CDF for BWR Event 14.
- NUREG/CR-6395 lists a value of 0.1 for the probability of impacting containment I&C systems. This probability value is used to calculate the CDF for PWR Event 9.

- NEDC-33054P proposes that the probability is “extremely small,” but does not propose an actual estimate. “Extremely small” is assumed to be much smaller than values listed in NUREG/CR-6395.
 - The contractor will provide a probability value and provide its technical basis including the basis for rejection, modification, or acceptance of the NEDC-33054P proposal of “extremely small.”
- (6) Probability of the Loss of all ECCS from Impact of I&C
- NUREG/CR-6395 lists a value of 0.75 for the probability of loss of all ECCS from impact on containment I&C systems. This probability value is used to calculate the CDF for BWR Event 14.
 - NUREG/CR-6395 lists a value of 0.5 for the probability of loss of all ECCS from impact on containment I&C systems. This probability value is used to calculate the CDF for PWR Event 9.
 - The BWROG proposes that the probability is “extremely small,” but does not propose an actual estimate.
 - The contractor will provide a probability value and provide its technical basis including the basis for rejection, modification, or acceptance of the NEDC-33054P proposal of “extremely small.” “Extremely small” is assumed to be much smaller than values listed in NUREG/CR-6395.
- 1.3.2 The contractor will perform a CDF sensitivity analysis by varying pipe break frequency estimates and sequence event probabilities for BWR Events 1, 5, 9, 10, 12, 14, and 16 and PWR Event 9 given in NUREG/CR-6395, to determine the overall impact of adopting or modifying accident frequencies and sequence probabilities given in NUREG-5750, “Rates of Initiating Events at U.S. Nuclear Power Plants: 1987-1995,” or other documents. A technical basis for parameter value changes must be given.
- Based on the conclusions made in Section 1.3.1 of this Task Order, the contractor will recalculate the CDF for the eight event sequences above, and provide a comparative discussion on the resultant outcome and changes (i.e., deviation from the results given in NUREG/CR-6395) for each of the eight events.
 - The contractor will provide recommendations for categorizing the eight events using guidance provided in Appendix C, “Criteria and Guidance for Technical Assessment of Candidate Reactor Generic Issues” to Management Directive 6.4, “Generic Issues Program.”
 - The contractor will provide recommendations and detailed potential regulatory solutions for any risk significant BWR or PWR events analyzed above.

1.4 TECHNICAL AND OTHER SPECIAL QUALIFICATIONS REQUIRED

Personnel identified for this contract must have an understanding of probability risk assessment techniques, individual plant examinations, plant operational data, and methodologies for estimating rare event frequency probabilities and trends. Personnel should understand the basis for event frequency and uncertainty estimations used in WASH-1400, "Reactor Safety Study—An Assessment of Accident Risks in U.S. Commercial Nuclear Power Plants," NUREG-1150, and NUREG/CR-5750, and be able to provide pros and cons of each. The analysis performed as part of this Task Order is particularly complex because of differences in licensee plant designs, methodologies, and assumptions for risk assessment. It is expected that the contractor will quickly understand NUREG/CR-6395 and its basis. It is also imperative that the contractors understand recent risk information contained in critical documents mentioned in this Task Order, and in particular, relevant design issues for the SEP-III plants.

1.5 LEVEL OF EFFORT

We anticipate the level of effort will involve 250 hours of senior level staff time. An additional 20 hours of administrative support will be needed to collect, maintain, and provide project management services.

1.6 PERIOD OF PERFORMANCE

The period of performance of this task order shall be from 4/15/2002 through 10/31/2002.

1.7 MEETINGS AND TRAVEL

For planning, project clarification, status briefings, and final task closure, it is estimated that half-day meetings will be held between the NRC and the contractor each month at NRC offices in Rockville, Maryland.

1.8 SCHEDULE AND DELIVERABLES

Monthly, the contractor shall submit a brief letter status report which summarizes: (a) significant technical findings and results; and (b) the expenditure of NRC funds. This report shall address the following categories: (1) staff and administrative effort, (2) travel expenses, (3) equipment and supplies, and (4) other costs. Each report shall include by category: (a) costs of the previous month, (b) cumulative costs and uncosted obligations to date, and (c) projections by month for the remainder of obligated funds. The first monthly report shall provide the initial projections. Subsequent reports shall either indicate revised projections or indicate "no change in the cost and uncosted expenditure projection." Two copies of this monthly report shall be submitted to the NRC Project Officer, Dr. Sidney Feld. This monthly report is due on the 20th day of the month following the month reported.

All draft material documenting the completed work shall be included as Technical Letter Reports accompanying each Monthly Business Letter Report. The contractor shall submit a draft report covering the two assigned topics of Section 1.3 by August 9, 2002. The Technical Monitor shall provide guidance on the depth and level of detail characterizing these monthly reports.

1.9 TECHNICAL DIRECTION

The Project Officer will be Dr. Sidney Feld, RES, 301-415-6193, and the Technical Monitor will be Ronald Lloyd, RES, 301-415-7479.

1.10 NRC FURNISHED MATERIALS

The NRC will provide any needed documents not available to the contractor, as necessary.