Central Files

JUN 12 1981

Mr. Gregory J. Ogeka
Administration Branch
DOE Brookhaven Area Office
Building 454
Upton, New York 11973

Dear Mr. Ogeka:

Subject: BNL Technical Assistance to the Division of Safety Technology, NRR, NRC, "SRV Line Break in BWR Wetwell," (FIN No. A-3385)

The enclosed NRC Form 173, Standard Order for DOE Work, is hereby submitted in accordance with Section III, B.2 of the DOE/NRC Memorandum of Understanding dated February 24, 1978.

Funding authorization in the amount of $40,000 to immediately begin work on the enclosed Statement of Work, which has been discussed with Dr. G. Maise of Brookhaven National Laboratories, is provided herein. The balance of funds required for project completion will be provided incrementally after receipt of an acceptable proposal.

Standard items and conditions for NRC work, as provided in the DOE/NRC Memorandum of Understanding of February 24, 1978, and described in NRC Manual Chapter 1102, should be used as the basis for preparing a proposal. If a portion of this work is to be subcontracted, it is required that BNL have a professional assigned to the contract who is qualified to defend the results. Also, prior approval by me in writing is required before initiation of any subcontractor effort. Please submit a proposal containing, as a minimum, the information set forth in Enclosure 2, Proposal Content, in the format of the Statement of Work, within 30 days to:

Mr. Bernard L. Grenier
Technical Assistance Program Manager
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

P2C-1-1

OFFICE ▶							
SURNAME ▶							
DATE ▶							

If you have any questions concerning the acceptance of this order, please contact Mr. B. L. Grenier on FTS 492-8041.

Sincerely,

Original signed by
Thomas E. Murley

Thomas E. Murley, Director
Division of Safety Technology
Office of Nuclear Reactor Regulation

Enclosures:
1. Statement of Work
2. Proposal Content
3. NRC Form 173

cc: w/enclosures
R. Barber, DOE-HQ
W. Kato, BNL
H. Grahn, BNL
R. Bauer, DOE/CHOO

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

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Thomas E. Murley, Director
Division of Safety Technology
Office of Nuclear Reactor Regulation

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R. Barber, DOE-HQ
W. Kato, BNL
H. Grahn, BNL
R. Bauer, DOE/CHOO

STATEMENT OF WORK

Project Title: SRV Line Break in BWR Wetwell

Fin No.: A-3385

B&R No.: 20-19-06-34

Technical Monitor: Tsung Ming Su, 492-9422

Cognizant Branch Chief: Karl Kniel, 492-7141

BACKGROUND

When the pressure inside a BWR reactor vessel exceeds a certain preset value (approximately 1000 psi), one or more safety relief valves (SRVs) open and the excess steam is ducted into the suppression pool where it condenses. This is a normal event which will happen many times during the life of a BWR plant. A potential accident sequence, involving failure of the SRV system, has recently been identified by the ACRS. If the SRV piping should develop a crack or rupture in the wetwell portion of the line, at a time when the SRV valve has failed to reclose after actuation, steam will escape into the wetwell airspace (instead of the pool). Some condensation will, of course, take place on the walls of the containment and the open surface of the pool. However, this condensation rate will be much lower than the complete condensation that would occur if the steam were ducted into the pool. The expected consequence of this accident is that the wetwell will experience a rapid pressure rise. A pressure differential will develop between the wetwell and drywell. This will cause the vacuum breakers to open, and the drywell will also be subjected to a similar pressure rise. Depending on the break size, this sequence of events could conceivably lead to containment pressures greater than the structural design. This accident sequence could occur in either a Mark I or Mark II BWR. It could not occur in the Mark III because in these plants the SRV piping enters the wetwell under the pool surface.

OBJECTIVE

The objective of this study is to analyze the following postulated accident scenario: Failure to reclose the SRV combined with the rupture of SRV piping in the BWR wetwell. A probabilistic assessment will also be conducted to determine the significance of the postulated accident in the context of overall reactor safety.

WORK REQUIREMENTS

All the tasks described below will be performed for both a typical Mark I and a typical Mark II plant. Peach Bottom 2 will most probably be selected as the Mark I plant because it was selected for the WASH-1400 probabilistic risk assessment, and failure rates for other components (than SRV piping) are readily available. The criteria for the selection of the Mark II plant will also be the extent to which probabilistic risk assessments have been carried out to date.

TASK 1 - Analyze Pressurization in Containment

Estimated Completion Date

Estimated Level of Effort: 5 man-months

October 30, 1981

The objective of this task is to estimate the pressure levels that would be reached in the containment structure. The task consists basically of computer runs (using CONTEMPT LT-26 or later version) to generate containment pressure histories resulting from SRV pipe failure in the BWR wetwell. To accomplish this task, the effects of various heat sinks, both passive and active (e.g., sprays), will be considered in the analysis. The system that will be modeled consists of two compartments, wetwell and drywell, connected by the vacuum breakers. A range of break sizes will be considered in the analysis.

TASK 2 - SRV Pipe Capability Analysis

Estimated Level of Effort: 2 man-months

November 30, 1981

The purpose of this task is to define the capability of the SRV piping to withstand the stresses that are imposed on it during SRV actuation. Various loading modes will be considered, including thermal cycling and fatigue effects during the life of the plant.

TASK 3 - Assess Significance of the Postulated Accident

Estimated Level of Effort: 5 man-months

February 26, 1982

The most important question is whether the postulated accident is significant within the context of overall BWR reactor safety. To answer this question, it will be necessary to assess the contribution of this particular initiating event to the overall level of risk of a BWR. Thus, Task 3 involves a probabilistic assessment of the risk due to accident sequences where SRV pipe failure is the initiating event. This will be done using the general methodology of WASH-1400, i.e., using event trees to define the accident sequences and reliability techniques to calculate the failure probabilities of the various mitigating systems involved in the accident sequences.

The failure probability for the SRV piping, which is needed to conduct this analysis, will be derived from considerations involving the capability of the SRV piping (available from Task 2), the loading

imposed during SRV actuation and the statistical distribution of strength of the SRV piping. The last item will probably be obtained by the examination of various available data banks on pipe failure rates. The failure probability for an SRV to reclose is already reasonably well established.

The failure probabilities of all the other components involved in the accident sequences are also needed for the risk assessment. These probabilities should be available and the analysis will be greatly simplified if plants for which Probabilistic Risk Assessment (PRA) has already been performed are chosen for the analysis. The consequences (amount and timing of radioactivity releases) of each accident sequence will be assessed using results of Tasks 1 and 2, as well as existing PRAs for BWRs.

LEVEL OF EFFORT AND PERIOD OF PERFORMANCE

The level of effort is estimated at one man-year over a nine-month period.

REPORTING REQUIREMENTS

1. Upon completion of Task 3, BNL will prepare and submit a reproducible topical report to the cognizant branch chief containing analyses and all significant technical conclusions.

2. A monthly business letter report will be submitted by the 15th of the month to the cognizant branch chief with a copy to the Director, DST. These reports will contain the following:

   - A summary of the progress and work completed during the period, including milestones reached or, if missed, an explanation provided;

   - The amount of funds expended during the period and cumulative to date;

   - If problems are encountered or anticipated, a description of the plans for their resolution, the schedule of their implementation and their impact on the overall program;

   - Plans for the next reporting period.

MEETINGS AND TRAVEL

BNL staff will participate in several meetings at NRC headquarters and at other locations to obtain source material for this study. These meetings may include attendance at hearings, visits to other laboratories or institutions and participation at professional meetings.

NOTE: BNL should estimate the number of trips, number of people and duration of meetings as part of its proposal.

NRC FURNISHED MATERIALS

The NRC staff will furnish the contractor with copies of the General Electric Company reports, applicant submittals, NUREG documents and NRC staff Task Action Plans. Some of this material will contain proprietary data, which will be held in confidence by BNL.

Enclosure 2

PROPOSAL CONTENT

The minimum items required in all proposals are:

1. Performing organization's name and location.

2. FIN Title, FIN Number, and B&R Number (NRC's) (as on statement of work).

3. Performing organization's key personnel, program manager, or principal investigator, their resumes and FTS phone number.

4. Background (definition of the problem including the objective(s) to be attained).

5. Work to be performed (Provide a concise description of tasks to be performed and expected results for the period of performance. Note technical data requirements, potential problems, and other technical information needed to fully explain the effort. Highlight changes from prior authorized SOW's, if any, identify changes in performance, schedule, or costs).

6. Identify major subcontracts, including consultants.

7. Costs estimated to be incurred by DOE contractors, subcontractors, and consultants. List by fiscal year to completion:

   a. Manyears of Technical Support (MTS)

   b. Costs:

      (1) Direct Salaries (Labor) for MTS

      (2) Material and Services (excluding ADP)

      (3) Total ADP Support

      (4) Subcontracts

      (5) Capital Equipment

      (6) Direct Travel Expense (Foreign travel must be shown separately)

      (7) General and Administrative Expense (Include indirect labor cost)

   c. Total Estimated Cost:

8. F[illegible]sts:

   [illegible]lestone Chart for accomplishing the work.

b. Planned monthly rate of costs for first fiscal year. This may be provided with the first report of an authorized program if not known at time of proposal submittal. At the beginning of each subsequent year, reports should include the planned monthly rate of costs for the ensuing year.

9. Conflict of Interest:

In order to assist the Commission in its evaluation, the DOE Contracting Officer shall describe any significant contractual and organizational relationships of the DOE, its contractor, their employees, or expected subcontractors or consultants on this proposal, with industries regulated by the NRC (e.g. utilities, etc.) and suppliers thereof (e.g. architect engineers and reactor manufacturers, etc.) that might give rise to an apparent or actual conflict of interest.

10. Reporting Requirements (as on statement of work).