

Some work under this task is anticipated to be proprietary.

If you have any questions about this authorization, please contact Mrs. S. H. Boyd on FTS 492-7685. Thank you for your assistance.

Sincerely,
Original signed by
Roger J. Mattson

Roger J. Mattson, Director
Division of Systems Integration
Office of Nuclear Reactor Regulation

Enclosures:

- 1. SOW (FIN A-3705)
- 2. Proposal Content

- cc: R. Bari, BNL
 T. Romano, BNL
 W. Kato, BNL
 W. T. Pratt, BNL
 H. Grahn, BNL
 R. Bauer, DOE-CH
 R. Barber, DOE-HQ

DISTRIBUTION
 NRR Project File (BGrenier)
 RSB S/F: TA
 JMeyer R/F
 RMattson
 TSpeis
 BSheron
 RSB R/F
 EMarinos
 NLauben
 SBoyd
 JMeyer
 DDandois
 DCorley
 ZRosztoczy
 VZeoli

PPAS: NRR
 BGrenier
 12/14/82

OFFICE	DSI:RSB	DSI:RSB	DSI:RSB	DSI:RS	DSI:AD:RS	DSI:DIR	DSI:DIR
NAME	JMeyer:gd	NLauben	BSheron	EMarinos	TSpeis	SBoyd	RMattson
DATE	12/14/82	12/21/82	12/21/82	12/21/82	12/22/82	12/15/82	12/14/82

ENCLOSURE 1

STATEMENT OF WORK

Title: Safety Evaluation of Core-Melt Accidents:
CESSAR-FDA, Westinghouse Standard Plant-FDA

FIN NO.: A-3705
B&R NO.: 20-19-40-41-3

Project Manager: J. Meyer (FTS 492-4752)
Technical Monitor: J. Meyer (FTS 492-4752)

Background and Objective

Consideration of severe accidents beyond the traditional design basis, including full core melt accidents, is an important part of NRC's overall safety assessment and therefore is becoming an important ingredient in specific licensing actions and in generic rulemaking proceedings. Also the consideration of features to mitigate the consequences of core melt accidents for nuclear facilities continues to be a major specific licensing activity. It is very important that the large amount of technical information available and being developed by, for example, RES in this area be appropriately assimilated, codified and evaluated in a way that is directly applicable to licensing needs. These needs are in three major areas. First, there is a need to better understand the progression or core melt accident sequences up to and including associated core melt related phenomenology and the implementation of these processes (and their uncertainties) into an overall assessment of containment loading and failure modes. The impact of mitigation strategies on containment loading and failure modes must also be factored into the assessment.

Second, based on the containment loading histories, there is a need to determine the radiological source term suspended in the containment, the effects on engineered safety features (E.S.Fs) and mitigation features of this source term and finally the release characteristics of this source term following containment failure.

Third, there is a need for an overall capability to assess the radiological consequences as a function of the assumptions regarding accident sequences, phenomenology and mitigation hardware. These radiological consequences must be further analyzed in a licensing context with a full appreciation of its regulatory implications.

The objective of the activities described in this Statement of Work is to meet the above needs.

The scope of this work will be limited to addressing immediate NRR licensing concerns using the state-of-the-art codes and the analyses and experimental data developed from NRC/RES and other R&D programs. The scope also includes review and evaluation of licensee submittals and other pertinent information dealing with the subjects described below.

The analyses provided under this contract will form the basis for the licensing decisions required on CESSAR-System 80 FDA review (PRA portion), and the Westinghouse Standard Plant, FDA (PRA portion) with respect to severe accident considerations.

The extensive analysis and assessment to be performed, code capability to be developed and experience to be gained under A-3711 has been taken into account in developing the RFP.

Work Requirements

The Work Requirements Are:

Task I: Severe-Accident Progression Analysis: Reactor Systems/Containment Systems Loading and Failure Modes.

Estimated Level of Effort in FY83: 7 MM Completion Date: 8/31/85
Estimated Level of Effort in FY84: 9 MM
Estimated Level of Effort in FY85: 10 MM

Subtask 1.A - Data Acquisition: Phenomenology Programs
Coordinate phenomenological input from FIN No.B8634. Provide cognizance of phenomenological studies of RES, IDCOR, and foreign programs. Relate the information gathered to MARCH predictions. This subtask supports directly the efforts in Subtask "I.D." Starting March 15, 1983, a letter report summarizing subtask status shall be provided every three months until the end of the contract. (Note: Subtask 1.A of FIN No.A3711 provides the overall evaluation in this area; the subtask above is limited to specific W and/or CESSAR items. This required letter report input can be combined with the letter report required in FIN No.A3711.)
...Completion Date: 8/31/85

Subtask I.B - Data Acquisition: Engineering Programs
Coordinate engineering mitigation feature input from FIN No.B8625. Provide Cognizance of engineering studies on containment and mitigation features of RES, IDCOR, DOE and foreign programs. Relate the information gathered to MARCH predictions. This subtask supports directly the efforts in subtask "I.D." Starting March 15, 1983, a letter report summarizing subtask status shall be provided every three months until the end of the contract. (Note: Subtask I.B of FIN No.A3711 provides the overall evaluation in this area; the subtask above is limited to specific W and/or CESSAR items. This required letter report input can be combined with the letter report required in FIN No.A3711)
...Completion Date: 8/31/85

Subtask I.C - MARCH/MELCOR Code Maintenance and Development:
 Closely follow RES's MARCH-2 and MELCOR development program. Follow the development of similar accident analysis codes e.g., INCORE, foreign and domestic and speciality codes, e.g., CORCON, CONTAIN. Maintain current MARCH code capability with modifications as appropriate to the reactor type under consideration and the containment modifications (mitigation features) being addressed. This subtask supports directly the efforts in subtask "I.D". Starting March 15, 1983, a letter report summarizing subtask status shall be provided every three months until the end of contract. (Note: Subtask I.C of FIN No.A3711 provides the overall evaluation in this area; the subtask above is limited to specific W and/or CESSAR items. This required letter report input can be combined with the letter report required in FIN No.A3711).
 ...Completion Date: 8/31/85

Subtask I.D - Accident Analysis: W/CESSAR
 For each reactor type under consideration, analyze the accident progressions up to and including containment failure characterizations based on accident sequences and containment modifications (if any) supplied by the staff (Pay particular attention to those containment failure parameters which are input to consequence analysis (CRAC code).)
 ...Completion Dates:
 I.D.1 CESSAR Preliminary... 8/31/84
 I.D.2 CESSAR Final..... 8/31/85
 I.D.3 W Preliminary..... 7/31/84
 I.D.4 W Final..... 7/31/85

Subtask I.E - Accident Assessment: W/CESSAR
 Review PRA submittals for these reactors within the scope of Task I as prepared by utilities/vendors. Generate questions to the utilities/vendors as needed. Provide write-ups of relevant areas within the scope of Task I for inclusion in staff assessments and testimony.
 ...Completion Dates:
 I.E.1 CESSAR Q1's... 9/30/83
 I.E.2 CESSAR Q2's... 9/30/84
 I.E.3 W Q1's..... 8/31/83
 I.E.4 W Q2's..... 8/31/84

Task II - Radionuclide Release Assessment

<u>Estimated Level of Effort in FY83:</u>	4 MM	Completion Date: 8/31/85
<u>Estimated Level of Effort in FY84:</u>	4 MM	
<u>Estimated Level of Effort in FY85:</u>	5 MM	

Subtask II.A - Data Acquisition: Source Term

Provide cognizance of this activity and proper coupling with CORRAL/MATADOR so that AED positions on source terms are properly translated into the CORRAL/MATADOR analyses of releases at containment failure. (The AEB branch of NRR/DSI is responsible for providing state-of-technology data on source terms for use in the CORRAL/MATADOR codes.)

Provide physical processes data to AEB in order to aid them in their source term evaluation (particle densities and particle sizes for determination of agglomeration rates in containment volumes).

This subtask supports directly the efforts in subtask "II.C." Starting March 15, 1983, a letter report summarizing subtask status shall be provided every three months until the end of the project. (Note: Subtask II.A of FIN No.A3711 provides the overall evaluation in this area; the subtask above is limited to specific W and/or CESSAR items. This required letter report Input can be combined with the letter report required in FIN No.A3711).

...Completion Date: 8/31/85

Subtask II.B - Data Acquisition: Code Development

Maintain close contact with RES development of MATADOR, NAUA CONTAIN and MELCOR. Provide assessments of progress to date and recommendations for the course of further development. And follow EPRI, IDCOR and foreign activities in this area. This subtask supports directly the efforts in subtask "II.C." Starting March 15, 1983, a letter report summarizing subtask status shall be provided every three months until the end of the project. (Note: Subtask II.B of FIN No.A3711 provides the overall evaluation in this area; the subtask above is limited to specific W and/or CESSAR items. This required letter report Input can be combined with the letter report required in FIN No.A3711).

...Completion Date: 8/31/85

Subtask II.C - Accident Analysis: W and CESSAR

For each reactor type under consideration, perform analyses of the release fractions and other containment failure parameters important in the subsequent consequence analysis. This effort is closely coupled to Subtask I.D and should be performed concurrent with Subtask I.D.

...Completion Dates:

- II.C.1 CESSAR preliminary... 8/31/84
- II.C.2 CESSAR final..... 8/31/85
- II.C.3 W preliminary..... 7/31/84
- II.C.4 W final..... 7/31/85

Subtask II.D - Accident Assessment: W and CESSAR
 Review PRA submittals in the areas within the scope of Task II by utilities/vendors. Generate questions to the utilities/vendors based on this review. Participate in meeting with the utilities/vendors as updated. Provide write-ups of relevant area within the scope of Task II scheduled for inclusion in staff assessments and testimony, and conform to schedules provided by staff below:

...Completion Dates:
 II.D.1 CESSAR Q1's.... 9/30/83
 II.D.2 CESSAR Q2's.... 9/30/84
 II.D.3 W Q1's..... 8/31/83
 II.D.4 W Q2's..... 8/31/84

Task III - Consequence Analysis

Estimated Level of Effort in FY83: 2 MM Completion Date: 8/31/85
Estimated Level of Effort in FY84: 2 MM
Estimated Level of Effort in FY85: 2 MM

- (Note: The AEB of NRR/DSI is responsible for all NRR consequences analyses. As such, Task III will be limited to the following activities related to consequences analysis:
- (1) CRAC analyses in order to determine the impact on risk of variations in the Task I & II analyses based on phenomenological uncertainties, engineering uncertainties and the incorporation of mitigation features
 - (2) CRAC analyses determining risk values at the request of AEB through RSB (as a supplement to AEB's own analyses.)

Subtask III.A- Data Acquisition: CRAC Code
 Keep abreast of the state of technology in the area of consequence analyses including working knowledge of CRAC-II and other related codes (e.g., CRAC - IT). Maintain a CRAC code capability and data files for the sites used in this study. This subtask supports directly the efforts in subtask "III.B." Starting March 15, 1983, a letter report summarizing subtask status shall be provided every three months until end of contract. (Note: Subtask III.A of FIN No.A3711 provides the overall evaluation in this area; the subtask above is limited to specific W and/or CESSAR items. This required letter report input can be combined with the letter report required in FIN No.A3711).

...Completion Date: 8/31/85

Subtask III.B- Accident Analysis
 Perform CRAC analyses consistent with the MARCH/CORRAL analyses performed in Subtask ID and IIC. Determine changes in risk based on inclusion of mitigation (or prevention) features and on

variations due to accident progression
uncertainties. (Note Milestone in II.C)
...Completion Date: 8/31/85

Task IV - Risk Assessment Summary (Integration of Tasks I, II, and III)

Estimated Level of Effort in FY83: 5 MM Completion Date: 8/31/85
Estimated Level of Effort in FY84: 6 MM
Estimated Level of Effort in FY85: 7 MM

Subtask IV.A - Integration: Containment Matrix

For the reactor being considered in this project, generate a containment matrix which shows the relationship of damage states (provided by the staff) to release categories, and defend each element of the matrix based on analyses and assessment provided in Task I & II. Determine estimates of uncertainties for each containment matrix element (to be used in Subtask IVC). Compare this matrix to that developed by the utility/vendor, if appropriate. ...Completion Date:

- IV.A.1 Preliminary: CESSAR...8/31/84
- IV.A.2 Preliminary: W..... 7/31/84
- IV.A.3 Final: CESSAR..... 8/31/85
- IV.A.4 Final: W..... 7/31/85

Subtask IV.B - Integration: Impact on Risk

Present results of analyses and assessment in Task I, II and III in terms of risk values (incl. CCDFs) and changes in risk values due to changes in containment designs (Mitigation features) or changes in damage state probabilities.

- IV.B.1 CESSAR: Letter Report
review of IPPSS..... 9/31/84
- IV.B.2 W: Letter Report
review of Zion... ... 8/31/84
- IV.B.3 CESSAR Final
Report (NUREG/CR).... 8/31/85
- IV.B.4 W Final Report
(NUREG/CR)... 7/31/85

Subtask IV.C - Integration: Uncertainty Analysis

Develop a methodology for translating containment matrix element uncertainties and other uncertainties (e.g., in damage states and CRAC analyses) into final uncertainties in final risk and risk reduction values making use of the RES and industry programs in this area.

...Completion Dates: Quarterly Reports

Level of Effort and Period of Performance

The level of effort is estimated at 63 man-months over a 33-month period.

Technical Reporting Requirements:

All products which are required from this contract (including NUREG/CR reports, and miscellaneous letter reports for input to SERs) have been identified specifically under each subtask in the Work Requirements Section. BNL shall submit six copies of draft NUREG/CR reports to the NRC Project Manager, for staff review and approval. For NUREG/CR reports, within sixty days of receipt of the staff's comments on these reports, the contractor shall submit one (1) reproducible and six (6) reproduced copies of the final reports in accordance with NRC Manual Chapter 3202, "Publication of Unclassified Regulatory and Technical Reports Prepared by NRC Contractors".

Business Letter Reports

A monthly business letter report will be submitted by the 15th of the month to the Project Manager with copies provided to the Director, Division of Systems Integration, ATTN: S. Boyd, T. Speis, B. Sheron, DSI, and Mr. B. L. Grenier, NRR. These reports will identify the title of the project, the FIN, the Principal Investigator, the period of performance, and the reporting period will contain 2 sections as follows:

Project Status Section

For each task under this program, provide the following information:

1. A list of the efforts completed during the period; milestones reached, or if missed, an explanation provided.
2. Any problems or delays encountered or anticipated and recommendation for resolution. 1/
3. A summary of progress to date (this may be expressed in terms of percentage completion for each task).
4. Plans for the next reporting period.

Financial Status Section

1. Provide the total cost (value) of the project as reflected in the proposal and the total amount of funds obligated to date.

1/ If the recommended resolution involves a contract modification, i.e., changes work requirements, level of effort (costs), or period of performance, a separate letter should be prepared and submitted to the Director, Division of Systems Integration, ATTN: S. Boyd, E. Marinos, DSI, and a copy provided to the Project Manager and B. L. Grenier, NRR.

2. Provide the total amount of funds expended (costed) during the period and total cumulative to date as follows:

	<u>Period</u>	<u>Cumulative</u>
a. Labor-related costs		
b. Computer services		
c. Travel		
d. Subcontracts		
e. Equipment		
Total	_____	_____ (%) <u>2/</u>

3. See attached format

Meeting and Travel

1. One one-day meeting each quarter in Bethesda to discuss performance and work progress should be planned and budgeted.
2. Two topical professional meetings on relevant topics should be planned and budgeted (one attendee).
3. One one-day meeting each quarter in Bethesda or at licensee/applicant headquarters with licensee/applicant and NRC staff.

NRC Furnished Materials

The NRC will provide any documentation relevant to the above tasks including that which is submitted by licensees/applicants during the course of this project. NRC will furnish copies of the latest relevant codes together with appropriate Users Manuals and description of subroutines.

2/ Provide percentage against total funds obligated to date.

3. Fee Recovery Cost Status Section

Pursuant to the provisions of NRC-Regulations, 10 CFR 170, provide the total amount of funds expended (costed) during the period and cumulative to date for each task in the following format:

FIN: B3705

TITLE: Safety Evaluation of Core-Melt Accidents: CESSAR-FDA; Westinghouse Standard Plant-FDA

Period:

Task I: Severe-Accident Progression Analysis: Reactor Systems/Containment Systems Loadings and Failure Modes

<u>Facility</u>	<u>Docket #</u>	<u>Period</u>	<u>Cumulative</u>
CESSAR-80	50-470		
Westinghouse Advanced Design	50-668		

Task II: Radionuclide Release Assessment

<u>Facility</u>	<u>Docket #</u>	<u>Period</u>	<u>Cumulative</u>
CESSAR-80	50-470		
Westinghouse Advanced Design	50-668		

Task III: Consequence Analysis

<u>Facility</u>	<u>Docket #</u>	<u>Period</u>	<u>Cumulative</u>
CESSAR-80	50-470		
Westinghouse Advanced Design	50-668		

Task IV: Risk Assessment Summary

<u>Facility</u>	<u>Docket #</u>	<u>Period</u>	<u>Cumulative</u>
CESSAR-80	50-470		
Westinghouse Advanced Design	50-668		

Note: If there is any effort under any of these tasks that is generic in nature such that the effort is required in order to perform the evaluation of any submittal, the cost for the generic effort should be prorated to each facility to which it applies.