SUPPLEMENTAL AGREEMENT
BETWEEN
GENERAL ELECTRIC COMPANY
AND
ELECTRIC POWER RESEARCH INSTITUTE, INC.
AND
THE U. S. NUCLEAR REGULATORY COMMISSION

THIS SUPPLEMENTAL AGREEMENT, effective the 16th day of July, 1982 by and between the UNITED STATES OF AMERICA (hereinafter referred to as the "Government"), as represented by the UNITED STATES NUCLEAR REGULATORY COMMISSION (hereinafter referred to as the "Commission"), and GENERAL ELECTRIC COMPANY, a corporation duly organized and existing under the laws of the State of New York with its principal office in Fairfield, Connecticut (hereinafter referred to as the "Contractor"), and ELECTRIC POWER RESEARCH INSTITUTE, INCORPORATED, a not-for-profit corporation duly organized and existing under the laws of the District of Columbia, with its principal office in Palo Alto, California (hereinafter referred to as the "Institute"),

WITNESSETH THAT:

WHEREAS, the Contractor has been performing work under Contract No. NRC-04-76-215;

WHEREAS, the parties desire to modify Contract No. NRC-04-76-215 as hereinafter provided, and this Supplemental Agreement is authorized by law, including the Federal Property and Administrative Services Act of 1949, as amended, the Atomic Energy Act of 1959, as amended, and the Energy Reorganization Act of 1974, as amended:

NOW THEREFORE, said Contract, as amended, is hereby further amended as follows:

1. Regarding ARTICLE II - STATEMENT OF WORK, Part 4. BWR FULL INTEGRAL SIMULATION TEST (FIST) PROGRAM

A substantial portion of the work under the BWR FIST Program, as set forth in Modification No. 11 hereto, has been completed. The Contract is further modified by deleting the Part 4 set forth in Modification No. 11 and superseding it with the following comprehensive workscope for the BWR FIST Program. The Contractor shall perform the tasks set forth in the following workscope so as to achieve the overall program objectives as well as the objective stated for each task.

"4. BWR FULL INTEGRAL SIMULATION TEST (FIST) PROGRAM

A. BACKGROUND

Phase I of the BWR FIST program, as described in Modification No. 11 to Contract No. NRC-0476-215, implements a major modification to the original TLTA test facility and included loss-of-coolant-accident tests with data evaluations.

During the PMG discussions (Aug-Dec 81) to define the follow-on program to cover operational transients, the PMG agreed to additional facility modifications and planning for these transients in order to optimize the total program.

Consequently the original Phase I LOCA program and the follow-on transient program began to merge as discussed in the GE proposal submitted to the PMG in Feb 82 to cover the program extension.

In view of this, the PMG requested that the total program be consolidated. Therefore this document covers the entire FIST program as initiated in 1981 through the proposed extension scheduled for completion in 1985.

B. PROGRAM OBJECTIVES

The overall objectives of the EPRI/NRC/GE BWR FIST test program are to:-

1. Implement the major modification to build the BWR FIST facility capable of simulating a spectrum of BWR system loss-of-inventory and selected operational transients.
2. Obtain and evaluate basic data from the test system configuration which has characteristics similar to a BWR with 8x8 fuel bundles during hypothetical loss-of-inventory and selected operational transients.
3. Provide phenomenological understanding and data to assess available best estimate models for BWR system and fuel bundles.
4. Perform model development work, as described herein, to assist in the development of best estimate methods of BWR TRAC for operational transients.

C. PROGRAM TECHNICAL DESCRIPTION

TASK 1: PROGRAM PLANNING & ADMINISTRATION

OBJECTIVE: Provide the overall planning and program management functions for the BWR FIST program.

1.1 Provide program management functions for this program including preparation of the periodic technical and administrative status reports

1.2 Provide primary contractor interface to the PMG

TASK 2: SCALING STUDY, TEST PLAN AND TEST SPECIFICATION

OBJECTIVES: Design the facility on a geometric scaling basis from a BWR 6/218 reference reactor system. Evaluate the design using BWR TRAC and the large break DBA and ensure that this evaluation covers the test matrix as described in Appendix B.

2.1 Perform scaling and design analyses for the FIST configuration to evaluate the reactor simulation accuracy. Particular attention shall be given to attaining a real time simulation of calculated BWR system and fuel bundle thermal-hydraulic response. Apply appropriate analytical methods (including BWR TRAC) used for BWR performance analyses to obtain best estimate performance predictions of the BWR reference plants and the test system configuration. Differences in anticipated dynamic response of the test apparatus as compared to a BWR shall be identified by appropriate analysis. Measurement requirements and an instrumentation plan shall be developed to meet the program objectives. Results of this effort will be documented in the BWR FIST facility description report and separate addendums to this report.

2.2 Prepare a detailed test plan which describes the complete integral simulation tests. The test plan shall include the test objectives, test description, test matrix (Ref Appendix B), parameter ranges and reasons for selection, test execution plan, planned utilization of the data and the planned schedule for completion of the BWR FIST Program.

2.3. Perform a thorough evaluation of the expected BWR behavior during the transient events described in Appendix B. The expected scenarios for these events will be derived from existing plant analyses. This study will be used to provide the basis for identifying the test simulation requirements such as initial conditions, boundary conditions, key events and others in BWR FIST.

2.4. TRAC BWR will be run for the limiting transients, using the detail BWR decks set up by INEL & GE. The objective of this study is to provide a basis for comparative evaluations with TRAC BWR FIST predictions for the same simulation transients (see 2.5).

2.5 TRAC-BWR FIST studies will be made to compare the predicted performance with the BWR (counterpart from 2.4). From the results of this study it may be necessary to modify the test procedures to reproduce key BWR events if they are not inherently present in BWR FIST. The TRAC-BWR FIST input models from Task 2.1 will be used with very minor modifications.

2.6 As a result of the comparative studies from 2.5 above, the test specifications will be derived. The programmed power response and time for key events will be specified to produce the desired simulation for the matrix tests. The various test specifications will be issued as separate addendums to the facility description report.

TASK 3: FACILITY DESIGN & CONSTRUCTION

OBJECTIVE: Design and build the BWR FIST Facility with heated feedwater system which has appropriate scaling to allow full integral simulation tests in a single-bundle BWR system configuration.

3.1 Complete the detailed design, procurement and assembly of components for the BWR FIST facility and instrumentation system. Assemble the components and prepare the facility for conducting shakedown tests.

3.2 Prepare a facility description report which presents the scaling and technical basis for the BWR FIST Facility and documents the results of Task 3.1 and 2.1. Following PMG review, modify the description document, as required, and prepare the document as approved by the PMG for publication. The PMG has the option to combine this report with the test plan report in Task 2.

3.3 Design, procure, and implement new data acquisition system hardware as needed for the BWR FIST facility. Develop the software necessary for the data acquisition and data reduction for both blowdown and transient testing.

3.4 Dismantle the existing TLTA test section and salvage the components to be used for BWR FIST. The expected instrumentation reuseable for BWR FIST includes approximately 50 transducers, signal conditioning for thermocouples and strain gage type circuits and various monitoring and control instruments such as digital voltmeters and the bundle power control

and measurement instrumentation. In addition 50 transducers and 3 thermocouple reference junction boxes were obtained from other GE test facilities.

TASK 4: FACILITY SHAKEDOWN AND PERFORMANCE TESTING

OBJECTIVE: Verify the design capability of the BWR FIST Facility hardware and instrumentation for conducting full integral simulation tests and establish the system operational characteristics.

4.1 Prepare the facility and auxiliary equipment for system hardware and instrumentation checkout and shakedown tests.

4.2 Perform the system hardware checkout and shakedown tests, including the adequacy of the heated feedwater system and BWR FIST heater bundle design. Verify the operation of the process instrumentation and controls and the test instrumentation.

4.3 Perform the system performance tests per the approved test plan. These performance tests shall include hydrostatic tests, flow calibration tests, transient startup tests and other system operational characteristic tests. These tests will determine heat loss, flow vs. pressure drop characteristics, instrumentation capability and performance characteristics to provide the basis for interpretation of the BWR FIST results.

4.4 Provide data from the facility shakedown and performance tests as an informal data report.

TASK 5: TESTING

OBJECTIVE: Obtain experimental data from the BWR FIST Facility.

5.1 Prepare the facility and instrumentation and perform the simulation tests per the approved test plan (Task 1), including acquisition of the appropriate pre and post-test measurement calibration data.

5.2 Reduce the data, as appropriate, to obtain:

a. system effluent (break and steam line) flow rates and enthalpies,

b. feedwater and ECC flows and enthalpies,

c. regional (lower plenum guide tube, core, core bypass, upper plenum, steam dome, and downcomer) fluid pressures, fluid temperatures and two-phase mixture levels,

d. differential pressure distributions within the regions and associated masses, density and void distributions and (where possible) internal flow rates between the regions, and

e. heater rod temperatures and surface heat transfer coefficients.

5.3. Verify the test data as specified in the approved test plan to ensure quality and consistency.

5.4 Process and store the measured and derived data on computer tape, made available through the INEL Data Bank System and supply data tapes to other system (data tran).

5.5 Perform bundle inspection and system recalibration midway through the test program (at the beginning of the second series of tests), and identify any major deviations from the original system calibration.

TASK 6: DATA EVALUATION

OBJECTIVE: Evaluate the data to identify and characterize the governing phenomena observed in the tests.

6.1 The tests selected (per PMG approval) for data evaluation will cover the range and type of tests described in Appendix B. Seven tests for Period 1 and eight tests for Period 2 are planned.

Evaluation will be performed mainly based on the direct measured and derived data. Analyses with analytical calculations and/or computer codes will be performed, as appropriate.

TASK 7: MODEL DEVELOPMENT

INTRODUCTION

Historically, the technologies for the analysis of system transients and loss of coolant accidents (LOCA) have developed separately. While they share many features in common, LOCA methods are dominated by the thermal hydraulic aspects because of the severity of the transients, the need to handle full heatup, and occurrence of the whole range of flow regimes. On the other hand, because of the immediate control rod scram and subsequent isolation of the vessel following a break, the neutron kinetics and control systems are of little importance and are given only cursory treatment in LOCA analysis. Conversely, methods for the analysis of the system dynamics during system transients must consider the neutron kinetics, balance of plant components and the control systems in great detail; but, are not usually equipped to deal with the complexity of the thermal hydraulics of accidents, such as film boiling, core uncovery and fuel heatup and damage. In recent years, the limitations of each of these branches of analysis have become apparent as the scope of safety analysis has expanded. The recent emphasis on degraded transients with multiple failures for operator guidelines and probabilistic risk assessment studies has considerably blurred the gap between traditional "transients" and "accidents" in terms of the calculational needs.

The model development under the TRAC-BD1/MOD1 program at the Idaho National Engineering Laboratory has made a start towards bridging this gap. The model development task under the FIST program will complement this activity at INEL, leading to a comprehensive safety analysis tool (TRAC-BD2).

This task supplements the other tasks in the FIST program which involve experimental investigations of various degraded transient simulations. The data from the experiments will serve to assess the thermal hydraulic models in the code for the conditions typical of these events. The resulting analytical method will be used to analyze and interpret the experimental results for reactor applications. As the experiments cannot provide exact simulations of the reactor, this modeling activity is a vital part of the BWR FIST

program to provide the final payoff from the tests. The models developed will be based on the TRAC-BD1/MOD1 program being developed at INEL. The scope of the work described below is intended to complement INEL plans without a duplication of effort. It has been discussed with the cognizant INEL staff and co-ordinated into a joint TRAC development plan. The work items consist of consultation and provision of information on BWR design and performance to INEL, as well as development of individual models. The model development task will be closely coordinated with INEL to maximize the benefits to the sponsors. Similar cooperative development with INEL under the Refill/Reflood Program has proved highly successful and resource efficient.

TRAC has been chosen as the vehicle for further development for several reasons. Experience with TRAC has demonstrated that it has the best framework for detailed thermal hydraulic analysis of the BWR. Significant effort has already been expended in development of component and basic models for TRAC to represent the BWR thermal hydraulic phenomena. Moreover, the work already underway at INEL to extend TRAC for transient applications allows for most efficient utilization of resources for supplementary model development.

WORKSCOPE

7.0 Task Plan

A task plan containing task objectives, a detailed description of the model development task and schedules will be developed.

7.1 Neutron Kinetics

INEL has incorporated a point kinetics model into TRAC-BD1/Mod 1. For some BWR transients considerable changes in the axial flux profile can occur (e.g., in the Peach Bottom turbine trip tests), which would require at least a 1-dimensional kinetics models. INEL has plans to extend the kinetics model at a later date. The activities in the BWR FIST program in this area would be to provide information and to assist INEL in the development and to participate in the assessment of the model.

The specific tasks which involve consultation and support to INEL are:

7.1.1 Choosing between a 1D and 3D kinetics model.

7.1.2 Information on existing kinetic models and functional dependence of nuclear parameters on moderator density, moderator and fuel temperature, control rod position and boron concentration.

7.1.3 Technique for averaging of 3-dimensional nuclear parameters to yield the necessary parameters for the 1-dimensional kinetics model.

7.1.4 Assessment of kinetics model (by GE).

7.2 Boron Transport

INEL has developed a simple tracking model for boron injected by the standby liquid control system, in which the boron is convected with the liquid assuming a homogeneous mixture. The high density of the sodium pentaborate solution, however, may cause stratification and imperfect mixing of the boron. The specific tasks under the FIST program would be to upgrade the boron model to include:

7.2.1 Stratification due to the high density of the sodium pentaborate solution.

7.2.2 Mixing due to turbulence and macroscopic convection of the liquid.

7.2.3 Plate out of the boron for the case of liquid boiloff.

7.2.4 Assessment of boron transport model (By GE).

7.3 Balance of Plant and System Simulation

To simulate the transient response of a BWR the entire system including the balance of plant must be modeled. This includes the turbine, condenser, feedwater heaters and auxiliary systems such as the residual heat removal systems. Models for these components are under development at INEL for TRAC-BD1/Mod 1.

A preliminary study will be performed to evaluate these models, the sensitivity of the models to the predicted BWR response and the extent of detail required. Improvements will then be made as necessary.

For the evaluation of long plant transients, it is also essential that an efficient calculational scheme be employed. This involves both numerical improvements to reduce the running costs and optimization of the system representation and noding for the classes of transient of interest.

The activities planned under this subtask are:

7.3.1 Evaluate the balance of plant models in TRAC-BD1/Mod 1. This will also serve as a preliminary assessment of the Mod 1 models in support of INEL. Propose improved models as necessary. Based on current developmental plans at INEL, the following two areas are potential candidates for improvement.

a) Models for turbine driven systems, such as turbine driven feedwater pumps and Reactor Core Isolation Cooling (RCIC) pumps.

b) Upgrade the condenser model being developed at INEL to include the effect of non-condensibles and the off-gas system.

7.3.2 Upgrade the efficiency of TRAC for system simulation and to provide a fast running and reliable code for the simulation of long transients. This activity will be closely co-ordinatied with INEL.

7.3.3 Assessment of balance of plant models following completion of 7.3.1 and 7.3.2 (By GE).

7.4 Containment

The purpose of the containment model is to provide realistic boundary conditions for the primary system in the form of containment pressure and pool temperature. Also, for the event of backflow into the reactor, the steam-air concentration in the containment is required. It is not the intent of the containment model to study pool dynamics or containment loads. A non-condensible air field has been developed by Los Alamos National Laboratory for TRAC-PF1 and will be implemented into TRAC-BD1/Mod. 1 by INEL. Furthermore, INEL is planning to include a simple containment module of the CONTEMPT class. The specific tasks under the FIST program will include evaluation of

the simple containment module developed by INEL and of the feasibility of using existing TRAC components for containment simulation. Assessment will be performed (by GE) against available containment data and recommendations made for further work if necessary.

7.5 Development Assessment

As the models are developed and implemented into TRAC, the overall performance of TRAC will be tested against representative data from the FIST facility, BWR plants and test problems. This verification activity will be performed (by GE) prior to releasing code versions for preliminary assessment. An output from this activity will be guidelines for users in key areas of nodalization and system set-up.

TASK 8: MODEL QUALIFICATION

8.1 The experimental data will be used for the assessment of available best estimate BWR transient thermal-hydraulic methods. The assessment includes pre-test predictions, comparisons with the data, and post-test analyses for the selected tests (Ref. Appendix C describing proposed TRAC analyses) in accordance with the approved test plan. The results of the assessment will identify areas in which the models from BWR TRAC can be improved for BWR performance evaluations. Results from these studies will be reported in the final report.

APPENDICES

Appendix A - NRC Contribution
Appendix B - Proposed Test Matrix
Appendix C - Proposed TRAC Analyses
Appendix D - Schedule

APPENDIX A - NRC Contribution

The BWR-FIST program as proposed implicitly assumes additional assistance from the NRC directly or via their designated subcontractor in the following specific areas:

	Description	Proposal Task
1.0	Computer The computer support activities are identified by task in the proposal.	2 through 8
2.0	Stress Analysis	3
2.1	Vessel Perform stress analysis on vessel per GE requirements.	
2.2	Piping Perform stress analysis on piping per GE requirements.	
3.0	Scaling Studies	2
3.1	BWR/TRAC System Analysis. Perform BWR/6 DBA analysis using TRAC to provide basis for BWR FIST design.	
3.2	BWR FIST-TRAC System Performance Comparison. Compare BWR/6 DBA analysis to FIST-DBA TRAC analysis (performed by GE) to evaluate the adequacy of the FIST design.	
4.0	BWR/TRAC Power Transient Analysis. Perform BWR/6 TRAC analysis to provide basis for FIST test specifications.	
5.0	Pre-test Predictions. Perform BWR FIST TRAC analysis for selected tests from the approved test matrix.	8
6.0.	Post-test Predictions. Perform same type of analysis as defined in 5.0.	8

7.0	Test Data Evaluation Evaluate and analyse selected test data to determine governing phenomena	6
8.0	On-Site Representative providing direct ·nical support to the program 75% of time.	3, 4 & 5
9.0	Data Processing Software Preparation of software based on GE requirements for data reduction and qualification	3
10.0	Data Qualification Provide assistance in qualification of test data.	5
11.0	Data Reduction Provide assistance in reduction of test data	5
12.0	Gamma Densitometer design, procurement, fabrication and implementation NOTE: This task is not included in the current proposal resources and schedule. However it is intended that the impact on the program be minimized by synchronizing installation with bundle re-assembly work for the later test period.	3
13.0	Model Development	7
13.1	Transmit TRAC-BD1/Mod 1 to GE (Est. Mar. '83)	
13.2	Transmit TRAC-BD2 to GE (Est. Mar. '85)	
13.3	Transmit kinetics model to GE (Est. Sept. '83)	

APPENDIX B

BWR FIST PROGRAM TESTS

Test No.	Description
1	Small Break - HPCS Line
2	Small Break with stuck S/RV
3	Large Break - Main Steam Line
4	Large Break DBA (BWR-4)
5	Small Break w/o HPCS
6	Power Transient (MSIV Closure)
7	BWR-4 Power Transient (MSIV Closure)
8	Power Transient (MSIV Closure, w/o HPCS)
9	Natural Circulation Tests
10	To be specified
11	Loss of Feedwater w/o HPCS, w/o RCIC
12	Loss of Feedwater with stuck S/RV, w/o HPCS
13	Loss of AC Power
14	Peach Bottom Turbine Trip
15	Large Break DBA
16	Intermediate Break
17	Small Break with HPCS
18-19	Power Transient Separate Effects (to be specified)
20-21	To be specified

APPENDIX C

PROPOSED TRAC ANALYSES

Task	TRAC Deck	Test No.	Test Condition	Objective	Performed By	Estimated Computer Cost $K
2.1 Scaling/ Design Analyses	FIST-TRAC	N/A	DBA Core Average Power with ECC	FIST System Response Evaluation	GE	50
	BWR/TRAC	N/A	DBA BWR/6 with ECC	BWR/6 System Response, Reference for FIST Study	INEL	---
2.4 BWR/TRAC Analyses	BWR/TRAC	6	Power Transient MSIV Closure	To provide information for Test Specification, Test Procedure, etc.	INEL	---
	BWR/TRAC	8 or other	Power Transient	To provide information for Test Specification, Test Procedure, etc.	GE	30
	BWR/TRAC	12	Transient with Scram Loss of Feedwater + Stuck RV + w/o HPCS	To provide information for Test Specification, Test Procedure, etc.	To Be Determined	
	BWR/TRAC	13 or other	Transient with Scram	To provide information for Test Specification, Test Procedure, etc.	GE	30

APPENDIX C

PROPOSED TRAC ANALYSES (Continued)

Task	TRAC Deck	Test No.	Test Condition	Objective	Performed By	Estimated Computer Cost $K
2.5 FIST/TRAC Analyses	FIST/TRAC*	N/A	N/A	To obtain test specification	GE	20
	FIST/TRAC*	N/A	N/A	To obtain test specification	GE	20
7.1 Kinetics	BWR/TRAC	N/A	N/A	Implementation of Kinetics	GE	5
				Verification, Sensitivity Studies		20
				Developmental assessment (The TRAC analysis for this activity requires the simulation of the entire BWR.)		20
7.2 Boron Transport	BWR/TRAC	N/A	N/A	Development of stratification model	GE	5
				Development of mixing model		5
				Development of plate out model		5
				Verification and developmental assessment		10
7.3 Balance of Plant and System Simulation	BWR/TRAC	N/A	N/A	Development of model for turbine driven systems	GE	10
				Development of model for air in condenser		10
				Development of improved efficiency		10
				Verification and developmental assessment		15

*Each Test Period.

APPENDIX C

PROPOSED TRAC ANALYSES (Continued)

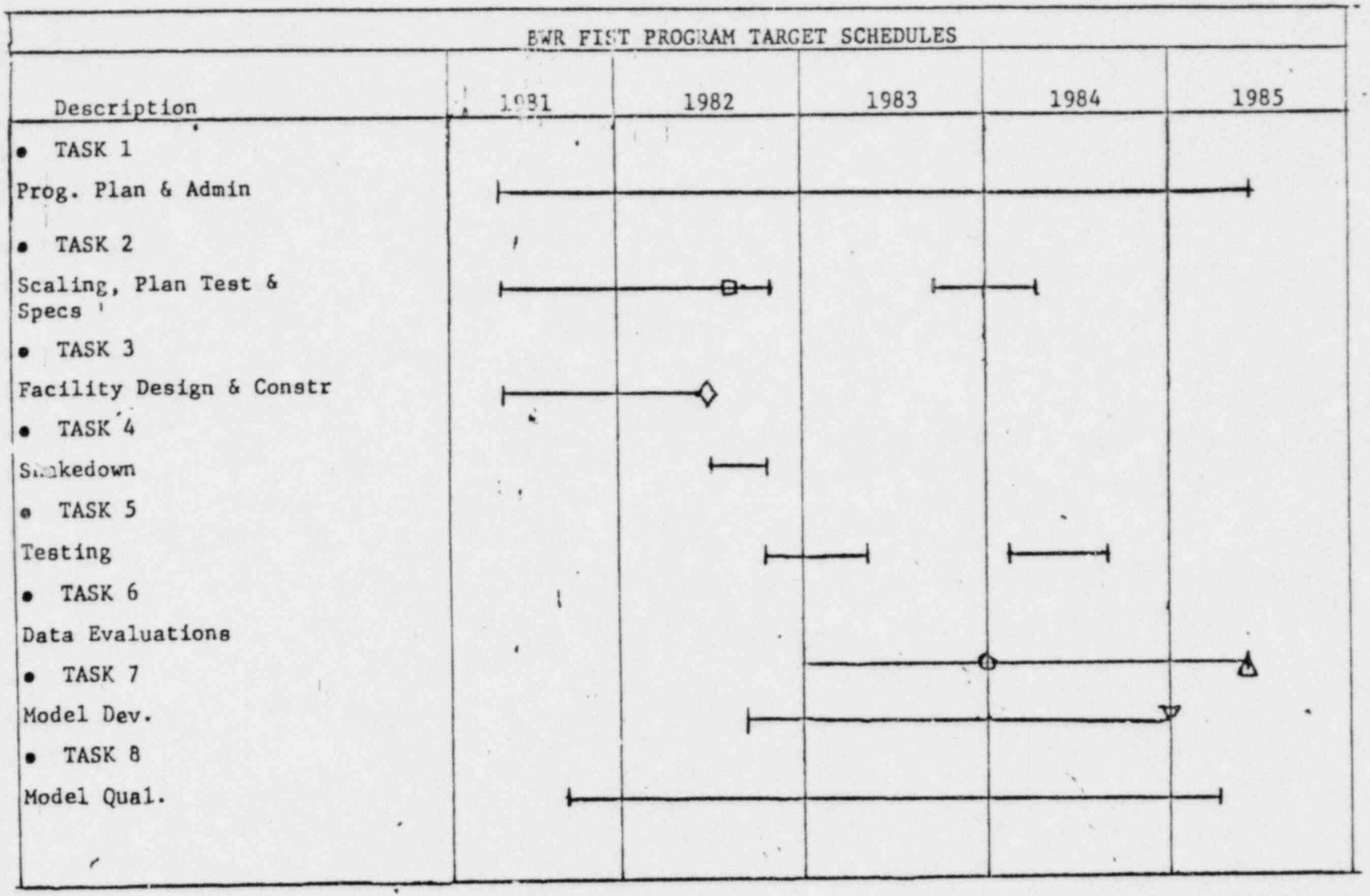
Task	TRAC Deck	Test No.	Test Condition	Objective	Performed By	Estimated Computer Cost $K
7.4 Containment	BWR/TRAC	N/A	N/A	Implementation of containment model	GE	5
				Procedures for containment simulation with TRAC		5
				Developmental assessment of containment models		20
7.5 Transient Plant Data Assessment	BWR/TRAC	N/A	N/A	Verification and developmental assessment of system performance, and comparison to selected plant data	GE	30
8.1 Model Qualification	FIST/TRAC	N/A	TLTA Tieback Test, DBA	Pretest Prediction	GE	20
	FIST/TRAC	5	SBA without HPCS	Pretest Prediction	GE	30
	FIST/TRAC	6	Power Transient	Pretest Prediction	INEL	---
	FIST/TRAC	18	Power Transient	Pretest Prediction	GE	30
	FIST/TRAC	12	Transient with Scram	Pretest Prediction	To Be Determined	
	FIST/TRAC	14	Transient with Scram	Pretest Prediction	GE	30

APPENDIX C

PROPOSED TRAC ANALYSES (Continued)

Task	TRAC Deck	Test No.	Test Condition	Objective	Performed By	Estimated Computer Cost $K
8.1 (Continued)	FIST/TRAC	5	SBA without HPCS	Post Test Prediction	GE	30
	FIST/TRAC	6	Power Transient	Post Test Prediction	INEL	---
	FIST/TRAC	12	Transient with Scram	Post Test Prediction	To Be Determined	
	FIST/TRAC	14	Transient with Scram	Post Test Prediction	GE	30

APPENDIX D


BWR FIST PROGRAM TARGET SCHEDULES
Description
1981
1982
1983
1984
1985
• TASK 1
Prog. Plan & Admin
• TASK 2
Scaling, Plan Test & Specs
• TASK 3
Facility Design & Constr
• TASK 4
Shakedown
• TASK 5
Testing
• TASK 6
Data Evaluations
• TASK 7
Model Dev.
• TASK 8
Model Qual.
REPORTS:
FIST Test Plan
Informal Interim
Final Data Evaluation
Facility Description
Model Development

2. Regarding ARTICLE III - PERIOD OF PERFORMANCE

The period of performance is hereby extended through a completion date of October 31, 1985 for completion of the work under this contract.

3. Regarding ARTICLE IV - ESTIMATE OF COST, OBLIGATION OF FUNDS, AND FIXED FEE

A. In Paragraph 1, Estimate of Cost, delete the amounts "$11,528,000.00", "4,803,333.37", "$3,842,666.63" and "$2,882,000.00", and insert in lieu thereof the amounts "$15,272,399.00", "$6,363,499.58", "$5,090,799.67", and "$3,818,099.75", respectively.

B. In Paragraph 3, Obligation of Funds

1. The amount obligated by the NRC for the performance of this contract is increased by $47,000.00 for a total obligated amount of $4,850,333.37.

2. The amount obligated by the EPRI for the performance of this contract is increased by $77,351.00 for a total obligated amount of $3,920,017.63 (balance from EPRI letter of June 23, 1982).

Note: The estimated cost and obligated amounts for the parties hereto are provided below.

	Total	NRC	EPRI	GE
Estimate of Cost	*$15,272,399.00	$6,363,499.58	$5,090,799.67	$3,818,099.75
Obligation of Funds	$12,588,450.75	$4,850,333.37	$3,920,017.63	$3,818,099.75

*The estimate of cost for the FIST Program is $7,647,224.00 with the balance of $7,625,175.00 having been expended on the predecessor BD/ECC Program.

C. In Paragraph 11, TASK COST LIMITATIONS

The following estimated costs are assigned by the PMG to each of the Tasks listed below. The specific Tasks and corresponding Estimated Cost on Modification No. 11 are deleted and superseded by the following:

Task (BWR FIST Program)		Estimated Cost
1.	Program Planning and Administration	$ 846,308
2.	Scaling Study, Test Plan and Test Specification	532,165
3.	Facility Design and Construction	3,305,681
4.	Facility Shakedown and Performance Testing	312,114
5.	Testing	1,530,071
6.	Data Evaluation	381,498
7.	Model Development	557,612
8.	Model Qualification	181,775
	Total	$7,647,224

4. Regarding ARTICLE IX - OTHER UNDERSTANDINGS AND AGREEMENTS

The following Paragraph 8 is hereby added and made a part hereof:

"8. Exclusive Use of BWR FIST Facility

a. The parties hereto agree to allow the Contractor exclusive use of the BWR FIST facility for an uninterrupted period of nine months during the performance period of this contract. The "exclusive use" period is scheduled to commence in June 1983 and end in February 1984.

b. During the "exclusive use" period in part a. above, no liability shall accrue to the Commission or Institute relative to the BWR FIST facility including, but not limited to, costs for operation, maintenance or repair.

c. The Contractor agrees to restore the BWR FIST facility to the original or better condition that existed prior to the commencement of the "exclusive use" period in part a. above and to absorb all costs required to restore the facility to said condition. Contractor will supply sufficient information for the PMG to determine the condition.

d. In the event that the facility is not fully restored by the ending date of the "exclusive use" period so as to preclude resumption of testing under this contract, the Contractor agrees to absorb all cost growth resulting therefrom, including but not limited to increases in direct labor rates, overhead and G&A, and material cost increases which could have otherwise been avoided had the performance of work under the contract not been delayed.

e. Notwithstanding part a. above, the "exclusive use" period may be interrupted in the event of a crisis requiring immediate access to the facility by the Commission and/or the Institute. Those instances shall be determined by the Program Management Group (PMG) or as otherwise provided in ARTICLE VII hereof entitled 'Program Management'. The Commission and/or Institute shall accrue no liability associated with any such interruption of the "exclusive use" period. In the event of an interruption of Contractor's period of exclusive use, the Contractor shall be given a day for day extension to said period, if desired. The Contractor shall not be liable for cost growth resulting from the day for day extension.

f. A facility use rate shall be developed and applied for future commercial use of the BWR FIST facility. Such rate shall not apply to the "exclusive use" period described in Paragraph 8a. This use rate will include all costs in

developing and maintaining the facility. The useful life of the facility will be mutually agreed upon by the PMG to come up with a usage fee. Such formula for commercial usage shall be incorporated into Article IX, paragraph 8 by future modification. Any fees collected shall be utilized to offset the costs of this contract. If the contract is complete, such fees will be remitted to the parties in accordance with the respective cost share ratios. The facility shall be maintained for such period as the PMG may agree.

g. The exclusive usage option shall be available on a non-interference basis to the PMG members under the same terms and conditions specified in paragraph 8 a-e above. Contractor would be able to use the facility for IR&D purposes, without payment of the use rate."

IN WITNESS WHEREOF, the parties have executed this document.

UNITED STATES OF AMERICA

BY: _____
Kellogg M. Morton, Chief
Research Contracts Branch
(Name and Title)

DATE: 8-18-82

U. S. NUCLEAR REGULATORY COMMISSION

GENERAL ELECTRIC COMPANY

BY: _____
H.H. Klepfer, General Manager
Nuclear Fuel Engineering Dept.
(Name and Title) 7/23/82

DATE: _____

ELECTRIC POWER RESEARCH INSTITUTE GNB

BY: _____
Bruce B. Rytkonen
Manager, Contract Negotiations
(Name and Title)

DATE: August 3, 1982