



LAWRENCE LIVERMORE LABORATORY

NUCLEAR SYSTEMS SAFETY PROGRAM

August 27, 1980
EM80-310

Mr. Franklin D. Coffman, Section Leader
Systems Interaction Branch
Division of Systems Integration
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Frank:

I am sending you a final statement-of-work for FY 80 which reflects our mutual understanding of the project as discussed in the August 8 meeting in Washington, D.C. and in our August 21 telephone conversation.

This final statement-of-work will be appended to the original, and hopefully will satisfy your needs at the NRC.

Sincerely,

Judy
Judy J. Lim, Project Leader
Systems Interaction Project
Nuclear Systems Safety Program

JJL:sac

cc: R. D. Bailey
G. E. Cummings/F. J. Tokarz

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PROGRAM AND BUDGET PROPOSAL
NUCLEAR REGULATORY COMMISSION

REVISED ---

DATE:
August 27, 1980

1. BUDGET ACTIVITY NO.:		2. OFFICE: NRR		3. PROJECT TITLE: Evaluation of Systems Interactions in Nuclear Power Plants	
4. METHOD OF REPORTING: <input checked="" type="checkbox"/> 1. MONTHLY LTR. <input type="checkbox"/> 4. ANNUAL <input type="checkbox"/> 2. QUARTERLY <input type="checkbox"/> 5. OTHER: <input type="checkbox"/> 3. SEMIANNUAL			5. PERSON IN CHARGE: L. L. Cleland F. J. Tokarz/G. E. Cummings Administrative Manager: R. D. Bailey		
6. CONTRACTOR: Lawrence Livermore National Laboratory		7. WORKING LOCATION-CITY: Livermore		8. STATE: California	
9. TYPE: <input type="checkbox"/> 1. INDUSTRIAL <input checked="" type="checkbox"/> 2. DOE LAB <input type="checkbox"/> 3. EDUCATIONAL <input type="checkbox"/> 4. GOVERNMENT <input type="checkbox"/> 5. OTHER NONPROFIT			10. CONTRACT NO.: W-7405-ENG-48		11. TASK NO.:
12. CONTRACT TERM-BEGIN: MONTH DAY YEAR FROM <input type="text" value="017"/> <input type="text" value="011"/> <input type="text" value="810"/>		13. CONTRACT TERM-END: MONTH DAY YEAR TO <input type="text" value="019"/> <input type="text" value="310"/> <input type="text" value="811"/>		14. TERMINATION DATE OF FUNDING: MONTH DAY YEAR <input type="text" value="112"/> <input type="text" value="310"/> <input type="text" value="811"/>	
15. XXX/XXX FTE		FY80	FY81	FY82	
Scientific		.25 FTE			
Other Direct					
Total Direct		.25 FTE			
16.a PROGRAM SUPPORT OBLIGATIONS					
a) Direct Salaries		20K			
b) Materials & Services		5K			
c) Subcontracts		60K			
d) Other Direct COMPUTER		1K			
Total Direct Costs		86K			
e) Indirect Costs		14K			
f) Fee					
Total (in Thousands)		\$100K			
15.b EQUIPMENT					
Equipment Obligations (in Thousands)					
Equipment Costs (in Thousands)					

COST AND DEVELOPMENT SCHEDULE

17. COST AND DEVELOPMENT SCHEDULE

a. COST

	Prior Years	Fiscal Years				Total Estimated Cost
		80	81	82 n ²	
Obligation Schedule ¹						
Subtask A						
Subtask B						
Subtask C						
Total Operations		\$100K				
(By fiscal year and total cumulative)						

¹ Cost breakdown should be developed such that the detail reflects the components of costs and provides meaningful data for evaluation and long range planning.

² The fiscal year in which the project/activity is completed.

b. DEVELOPMENT SCHEDULE

Within this section the contractor is to identify the start and finish dates for each subtask and by year the major events or milestones associated with each subtask.

18. Publications.
19. Scope (describe work effort). If scope is different from initial authorization, indicate to what extent.
20. Relationship to Other Projects.
21. Technical accomplishments in FY 1977.
22. Expected results in FY 1978.
23. Expected results in FY 1979.
24. Expected results beyond budget year.
25. * Description and Justification of Major Materials, Subcontract Items and other unusual significant cost items.
26. * Description, justification, and sequential priority of all equipment items.
27. * Utilization of facilities and test installation.

* If not applicable, place NA beside item number. Sequence of numbers should be maintained.

17. Cost and Development Schedule

17.1 Cost (Phase I)

Task	Description	Total Estimated Cost
1	Review FY80 Study of seismic effects on Diablo Canyon safety and provide systems interaction support for Diablo Canyon	\$20K
2	Provide definition of systems interaction and examples with corresponding safety failure criteria	\$25K
3	Survey state-of-the-art in systems methods for assessment of systems interaction	\$45K
4	Recommend a methodology or alternative(s) that show the best potential for further development and near-term use	\$10K
	Total	\$100K

The above estimated costs are for FY80 effort and include travel, computer usage, documentation, and other direct and indirect expenses as required.

17.2 Development Schedule (Phase I)

17.2.1 Deliverables

The deliverable for Task 1 will be LLNL participation in the October 1980 ACRS meeting on the review of the Diablo Canyon systems interaction evaluation. The deliverables for Tasks 2, 3, and 4 will be documentation on the results of each task combined in a single final report. In addition, the LLNL will provide the NRR with a proposed program which will be delivered 2 - 3 months after the initiation of Phase I.

17.2.2 Time Schedule

Task 1 was initiated in July 1980 and will be completed upon LLNL participation in the October 1980 ACRS meeting.

Tasks 2, 3, 4, will require three months time to complete, with a start date of August 1, 1980. Figure 1 shows the schedule of delivery for Phase I

FY80 - 31

AUG SEP OCT NOV DEC JAN FEB MAR APR MAY JUN JLY

Phase I

Task 1:	Review FY80 Study of Seismic Effects on Diablo Canyon Safety	B	
Task 2:	Provide Definition of Systems Interaction		
Task 3:	Survey State-of-the-Art in Systems Methods	R	
Task 4:	Recommend a Methodology or Alternative(s)	P	

R = Report
P = Proposal
B = Briefing (tentative)

FIGURE 1. Development Schedule

A MODIFIED PROPOSAL FOR THE STATE-OF-THE-ART
REVIEW AND EVALUATION OF
SYSTEMS INTERACTION METHODS
(FY80)

Judy J. Lim
Nuclear Systems Safety Program

August 27, 1980

Lawrence Livermore National Laboratory
Livermore, California

19. Scope

The LLNL will limit its study to addressing the "Systems Interaction" issue for light water reactors. Since a consensus regarding the definition and assessment methodology is lacking, the LLNL will focus on defining the systems interaction problem and evaluating existing and potential methodologies. In particular, the LLNL will review current risk assessment methods used to identify high-risk accident sequences at individual nuclear plants and will develop and implement an improved systematic approach for plant safety evaluation.

The ultimate goal of the LLNL effort will be to provide guidance to the U.S. NRC for the determination of regulatory initiatives to reduce high risk, systems interaction problems.

19.1 Description of Work

There are two phases planned for this project; Phase I in FY80 and Phase II in FY81 and beyond. The Phase I effort consists of a definition of the systems interaction problem, a review of past and ongoing systems interaction work, a survey of the state-of-the-art in systems methods, and recommendations for methods development for near-term use by industry and the NRC. A brief description of the Phase I tasks follows.

Task 1. Review FY80 Study of Seismic Effects on Diablo Canyon Safety

This task shall review the FY80 findings of the overall effects on the Diablo Canyon safety system function of the failure of nonseismic equipment components and structures due to severe earthquakes. This task shall also provide consultation to the NRC staff regarding review questions and the final safety evaluation for Diablo Canyon.

Travel to Diablo Canyon and Washington, D. C. may be required.

Task 2. Provide Definition of Systems Interaction

This task shall provide a technical and operational definition of systems interaction so that there will be a concurrent basis for the development of regulatory requirements and guidance and also for the evaluation and development of assessment methodologies. In providing the definition, the LLNL shall consider licensee event reports (LER) provided by the NRC to develop examples of a range of systems interaction problems.

Task 3. Survey state-of-the-art in Systems Methods for Assessment of Systems Interaction

This task shall survey and comment on alternative state-of-the-art methodologies in systems analysis for application in the evaluation of systems interaction. In particular, the results of the study performed by Sandia Laboratories on the development of fault tree methodology for the identification and evaluation of systems interactions in LWR power plants will be reviewed.

Issues such as

- o scope and rationale of study (i.e., criteria for Top Event selection, etc.)
- o robustness of methodology
- o applicability of methodology

will be addressed for each methodology reviewed.

Travel to Sandia Laboratories in Albuquerque, New Mexico may be required.

Task 4. Recommend Methodology Development for Near-Term Use

This task shall incorporate the knowledge and insight gained in Tasks 1, 2 and 3 to recommend a methodology or alternative(s) which shows the best potential for further development and near-term use by industry and the NRC for operating plant systems interaction evaluations. In addition, the LLNL shall propose a program plan for follow-on studies in FY81 and FY82. The proposed plan will address:

- o Generalized Assessment Methodology for SI
- o Criteria for Importance Ranking of SI
- o Quantification of SI Importance Measures
- o Validation of SI Models (through history and experiences in SI and results from SI evaluations)
- o Identification of Critical SI Components
- o Recommendations for Modification or "Fixing" of Critical SI Components
- o Value-Impact Methodology to Evaluate Alternative Recommendations for SI Problem

The LLNL shall develop the program plan with the NRR so that it may be readily incorporated into an integrated plan for addressing the broader question of system reliability in conjunction with IREP and other efforts.

Travel to the NRC in Washington, D.C. will be required for participation in SI peer reviews and coordination of program plan.

19.2 Reporting

19.2.1 Progress Reports

There will be monthly progress letters of 1 to 2 pages on the activities completed, the amount of funds expended, and any problems or delays encountered or anticipated.

19.2.2 Final Reports

Final reports for the various project tasks will be delivered according to the development schedule shown in Figure 1. All final reports will be submitted to the NRR for review before release.

20. Relationship to Other Projects

This project is related to on-going systems interaction work (i.e., USI-A17) at Sandia Laboratories in Albuquerque, New Mexico. Sandia is focusing on the verification of the system fault trees and the evaluation of the assessment results.

21. Technical Accomplishments in FY 1979 - N/A

22. Expected Results in FY 1980

As indicated in the development schedule, the following products are to be delivered for FY80 work.

Task	Deliverable	Estimated Completion Date
1	LLNL Participation in ACRS Meeting on Diablo Canyon Safety Review	Middle of October, 1980
2,3,4	Survey of state-of-the-art in Systems Methods, Final Report	End of October, 1980
4	Program Plan for further Technical Assistance, Proposal	End of September, 1980

24. Expected Results Beyond Budget Year

Expected future project results will be

1. Development of SI method recommended in FY80 study for near-term use.
2. Development of SI regulatory guidance.
3. Participation in government/industry seminar to discuss SI regulatory guidance.
4. Review of selected LWR sites for SI problems.

Details of these expected results will be specified in the forthcoming program plan.

25. Subcontracting

The LLNL shall be subcontracting some of the project work to

- 1) Science Applications, Inc., (SAI) of Palo Alto, California, and
- 2) Applied Decision Analysis, Inc., (ADA) of Palo Alto, California

J. E. Kelly and F. L. Leverenz of SAI can provide valuable project support because of their extensive experience in safety and reliability analyses of nuclear systems. Both of these individuals contributed to WASH-1400 (Reactor Safety Study).

T. R. Rice and R. K. McCord of ADA, Inc., can offer various perspectives on SI evaluation methods because of their expertise and experience in decision and systems analysis.

The individuals involved will not be performing work for any parties which may lead to a conflict of interest with the NRC. If such a situation should arise, the project participation of the individual and/or the subcontract with the LLNL will be terminated.

The LLNL will provide the technical lead for all subcontract work and maintain cognizant control over all technical and administrative matters.

The total subcontract charges are for technical personnel at

.67 FTE @ \$90K/FTE for FY80 = \$60K

26. Deliverables

Refer to Section 17.2.1 and Figure 1 for deliverables.