

# Los Alamos

Los Alamos National Laboratory  
Los Alamos, New Mexico 87545

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TELEPHONE

November 14, 1984  
Q-6-955 (R21W)  
K557  
(505)667-9207  
FTS 843-9207

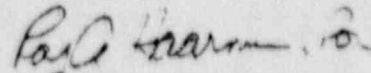
## Safety Assessment

Mr. D. M. Carlson  
US Nuclear Regulatory Commission  
Fuel Facility SG Licensing Branch  
Division of Safeguards, NMSS  
Mail Stop 881-SS  
7915 Eastern Avenue  
Silver Spring, MD 20555

Dear Don:

Enclosed is the work plan required as part of Task 1 of the "Consequences of Sabotage at Nonpower Reactors," FIN number A7153-4. This work plan includes reporting requirements for each task, including Task 4, which was inadvertently left out of the Los Alamos National Laboratory proposal sent previously. As we discussed on November 7, 1984, Task 4 is reported with Task 3 in an interim report. If you have questions, please call me.

Sincerely,



T. F. Bott

TFB/cd

Enc. as cited

Cy: M. G. Stevenson/W. L. Kirk, Q-00, MS E561  
L. H. Sullivan/J. R. Ireland, Q-00/RS, MS K552  
R. A. Haarman/W. S. Gregory, Q-6, MS K557  
CRM-4 (2), MS A150  
Q-6 File

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CONSEQUENCES OF SABOTAGE OF NONPOWER REACTORS  
WORK PLAN

I. INTRODUCTION

Because of the developmental nature of this study, Los Alamos will approach this work in two phases. The first phase, to be completed in FY 1985, will develop the methodology and apply it to three reactors, which hereafter are referred to as lead reactors (LRs). After this phase of work, a detailed plan for completing the remaining five reactors will be formulated based on the data gained in the LR phase.

In the LR phase (FY 1985), three representative nonpower reactors (NPRs) will be fully analyzed by October 1, 1985, as shown in the timetable for the work (Table I). These reactors are the NBS reactor, the largest NPR representing tank reactors; the University of Missouri reactor, the largest enclosed pool reactor; and the Georgia Institute of Technology reactor because of the limited amount of cooling water for the reactor power level. Based on the results of these three calculations, a better estimate of the time and cost required to perform the remaining calculations can be made for FY 1986.

II. TASK BREAKDOWN FOR LEAD REACTOR PHASE (FY 1985)

Task 1. Collection of Information and Familiarization With It

This task will be initiated immediately and will continue as required to gain a familiarity with the three LRs. Information available at Los Alamos will be supplemented by docket information from NRC and with site visits when sufficient familiarity is gained to make the visit meaningful.

Task 2. Calculation of Maximum Radiological Release

- a. Develop core inventory analyses and apply them to the three LRs for an operating history of the maximum authorized power level long enough to achieve equilibrium fission product levels. Both high- and low-enrichment fuels will be considered.
- b. Use a Master Logic Diagram (MLD) to identify potential physical modes of core disruption or other radionuclide sources for each LR.

- c. The maximum extent of core damage for each mode identified in the previous step and the fission product release associated with this damage will be determined using available methods. If no methods exist for a given requirement, an approximate and conservative analytical tool will be developed based on the best current knowledge.
- d. The effects of physical decontamination factors on the radionuclide transport will be calculated using currently accepted methods and site-specific information for each LR.
- e. The whole-body radiation dose and thyroid dose from iodine will be calculated in rem using currently accepted methods for the potential releases identified for each LR. Mean meteorological conditions at each LR will be assumed.
- f. This study will be terminated for those sites with no identified sequence leading to at least a 10 CFR Part 20 release.
- g. For those LRs that have sequences exceeding 10 CFR 20 or 10 CFR 100 releases, the extent of core damage leading to these releases will be calculated by scaling results from previous calculations in Task 2.d.
- h. All results from the foregoing calculations will be documented and submitted to NRC as an interim technical report.

### Task 3. Determination of Sources of Damage

- a. For each damage mode capable of resulting in at least a 10 CFR Part 20 or 100 release, the credible sources of such damage (for example, explosives and/or incendiary devices) will be identified.
- b. Using explosive yield, structural response, and other analyses, the amount and placement of damage sources resulting in the maximum release will be determined assuming no mitigating system functions and assuming that the adversary has direct access to all reactor components.
- c. The calculations of Task 3 will be repeated allowing safeguards credit for any physical barriers blocking direct access to the reactor fuel.
- d. The results of this task will be reported in an interim report to the NRC.

Task 4. Scaling of Damage Sources to 10 CFR 20 and 10 CFR 100

- a. The results of Task 3 will be scaled to determine the damage sources leading to 10 CFR 20 and 10 CFR 100 releases.
- b. The results of this task will be reported along with Task 3 in an interim report to the NRC.

Task 5. Determination of Misoperation Scenarios

- a. Using LR system descriptions, damage modes from Task 2, and damage sources from Task 3, a system logic model (fault-tree) approach will be used to determine sabotage scenarios resulting from unauthorized operation of reactor controls, systems, or fuels.
- b. The results of this task will be documented in an interim report for the NRC.

Task 6. Mitigating Systems Effects

- a. Using the sabotage scenarios developed in Task 5, the effect of mitigating systems on radionuclide release will be included using system logic models (fault trees) to determine the effects of both full and partial operation of mitigating systems.
- b. Using the insights of Task 6.a above additional or modified safety features or administrative practices that could be adopted will be identified.
- c. The results of this task will be documented along with Task 5 in an interim report for the NRC.

Task 7. Program Plan for FY 1986

Upon the conclusion of the LR analyses, a detailed plan for completing the remaining five nonpower reactors in FY 1986 will be formulated and submitted to the NRC.



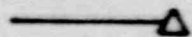
TABLE I  
TIMETABLE

TASK 2	O	N	D	J	F	M	A	M	J	J	A	S
a. Core Inventory Calculations	—————				△							
b. Identify Damage Modes	—————				△							
c. Determine Core Damage			—————		△							
d. Radionuclide Release			—————		△							
e. Whole Body Dose					—————		△					
f. Terminate Studies as Applicable					—————		△					
g. Part 20 and 100 Release Damage Determination					—————		△					
h. Report				—————								△

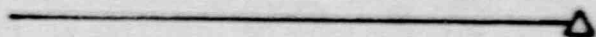
TASK 3

O N D J F M A M J J A S

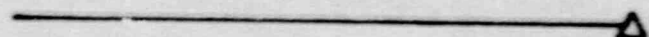
a. Identify Damage Sources



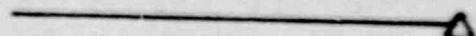
b. Calculate Amount of Damage Source



c. Include Effects of Safeguards Barriers

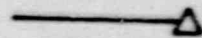


d. Report

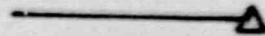


TASK 4

a. Scale Results of Task 3 to Part 20 and 100 Releases



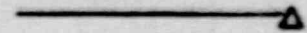
b. Report with Task 3



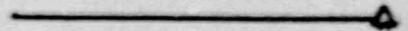
TASK 5

O N D J F M A M J J A S

a. Construct Logic Models for  
Scenarios

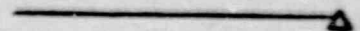


b. Report

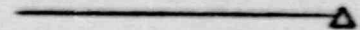


TASK 6

a. Construct Logic Models



b. Make Recommendations on  
Improved Safeguards



c. Report with Task 5



TASK 7

a. Submit Program Plan  
for FY 1986

