

ENCLOSURE 1

NRC FORM 173 (2-78)		U.S. NUCLEAR REGULATORY COMMISSION		ORDER NUMBER 20-81-299	
<b>STANDARD ORDER FOR DOE WORK</b>				DATE June 12, 1981	
ISSUED TO: (DOE Office) Albuquerque Operations Office		ISSUED BY: (NRC Office) Office of Nuclear Reactor Regulation, DL		ACCOUNTING CITATION APPROPRIATION SYMBOL 31X0200.201	
PERFORMING ORGANIZATION AND LOCATION Los Alamos National Laboratory Los Alamos, New Mexico				B&R NUMBER 20-19-07-08	
FIN TITLE Evaluation of Thermodynamics and Fission Product Releases following a DBA for Nonpower Reactors				FIN NUMBER A-7261-1	
				WORK PERIOD - THIS ORDER FIXED <input type="checkbox"/> ESTIMATED <input checked="" type="checkbox"/> FROM: 7/1/81 TO: 9/30/83	
OBLIGATION AVAILABILITY PROVIDED BY:					
A. THIS ORDER				\$ 40,000	
B. TOTAL OF ORDERS PLACED PRIOR TO THIS DATE WITH THE PERFORMING ORGANIZATION UNDER THE SAME "APPROPRIATION SYMBOL" AND THE FIRST FOUR DIGITS OF THE "B&R NUMBER" CITED ABOVE.				\$ 1,107,000	
C. TOTAL ORDERS TO DATE (TOTAL A & B)				\$ 1,147,000	
D. AMOUNT INCLUDED IN "C" APPLICABLE TO THE "FIN NUMBER" CITED IN THIS ORDER.				\$ 40,000	
FINANCIAL FLEXIBILITY: <input checked="" type="checkbox"/> FUNDS WILL NOT BE REPROGRAMMED BETWEEN FINs. LINE D CONSTITUTES A LIMITATION ON OBLIGATIONS AUTHORIZED. <input type="checkbox"/> FUNDS MAY BE REPROGRAMMED NOT TO EXCEED ± 10% OF FIN LEVEL UP TO \$50K. LINE C CONSTITUTES A LIMITATION ON OBLIGATIONS AUTHORIZED.					
STANDARD TERMS AND CONDITIONS PROVIDED DOE ARE CONSIDERED PART OF THIS ORDER UNLESS OTHERWISE NOTED.					
ATTACHMENTS: THE FOLLOWING ATTACHMENTS ARE HEREBY MADE A PART OF THIS ORDER: <input checked="" type="checkbox"/> STATEMENT OF WORK <input type="checkbox"/> ADDITIONAL TERMS AND CONDITIONS <input type="checkbox"/> OTHER			SECURITY: <input checked="" type="checkbox"/> WORK ON THIS ORDER IS NOT CLASSIFIED. <input type="checkbox"/> WORK ON THIS ORDER INVOLVES CLASSIFIED INFORMATION. NRC FORM 187 IS ATTACHED.		
REMARKS: This order provides funding to begin work on the enclosed Statement of Work and requests a proposal within 30 days. After acceptance, please send to the NRC Office of the Controller, ATTN: D. Dandois and provide a copy to the Office of Nuclear Reactor Regulation, ATTN: D. Corley					
ISSUING AUTHORITY SIGNATURE: <i>B. L. Grenier</i> 6/12/81 TITLE: Technical Assistance Program Manager			ACCEPTING ORGANIZATION SIGNATURE: _____ TITLE: _____ DATE: _____		

NRC FORM 173 (2-78)

8107140181 810618  
 PDR ORG EUSDOE  
 PDR

## 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 numbers.
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 Expenses (Include indirect labor cost)
  - c. Total Estimated Cost:

8. Forecasts:

- a. Milestone Chart for accomplishing the work.
- b. Planned monthly rate of costs by            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 to actual conflict of interest.

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

## ENCLOSURE 3

### STATEMENT OF WORK

Title: EVALUATION of THERMODYNAMICS AND FISSION PRODUCT RELEASES  
FOLLOWING A DESIGN BASIS ACCIDENT FOR NON-POWER REACTORS

FIN NO.: A-7261  
B&R No.: 20-19-01-08

Technical Monitor: Harold Bernard (FTS 492-8357)  
Cognizant NRR Manager: James R. Miller (FTS 492-7014)

#### BACKGROUND

The general types of research reactors are AGN's, Argonaut's, TRIGAs, pool and tank type. Pool and tank types also are test reactors.

Similarities within types make them conducive to generic safety analyses with concomitant savings in time and resources. For example, other than TRIGA and AGN research reactors. Most of the remaining research reactors utilize MTR-type fuels. Eleven MTR-type and eight TRIGAs have applied for license renewals. The scenarios for a Design Basis Accident (DBA) for the different reactor concepts include a series of events for which there is insufficient information available upon which to derive safety evaluations. Much of the required information is available from other sources but must be remoulded into a form that is useful for research reactor safety considerations.

#### OBJECTIVE

The objective of this project is to determine the thermodynamic results and fission product transport from the core into the environment of design basis events for use in evaluating SARs of research and test reactors.

#### WORK REQUIREMENTS

With a loss of coolant and components of the core fuel assemblies in both the vertical and horizontal directions so only 10-30% of the air channel is available for critical fuel cooling, determine the temperature, chemical history, physical and chemical aspects of the fuel, and fission product fate and transport to the exterior of the containment or confinement structures. As part of this analysis, it will be required that the contractor visit types of research and test reactors to obtain similarities of characteristics. The specific tasks to be performed are as follows:

- Task 1. Develop DBA scenarios for different types of research reactors.
- Task 2. Update various thermodynamic models pertaining to melting and fission product releases. Determine contrasts between two dimensional and three dimensional analyses for types of reactors and power levels.
- Task 3. Assess limitations on operation to preclude melting of clad or fuel for
- 100 kW operation
  - 500 kW operation
  - 1,000 kW operation
  - 2,000 kW operation
- Task 4. Determine seismic impacts for acceleration loads and vertical crushing due to structure collapse for those reactors subject to potentially catastrophic seismic conditions.
- Task 5. Following approval of scenarios, determine impact of fires on core damage, safety systems and fission product release.
- Task 6. Develop criteria for fission product transport and exposure for different research and test reactor fuel types.
- . In-core plate out
  - . In-core solution
  - . Reactor room plate-out
  - . Containment Confinement fission product removal systems
  - . Others
- Task 7. Determine exposures and concentrations within confinement/containment structures for iodines, noble gases, and any other critical fission products for distance from the core of:
- 50 ft
  - 100 ft
  - 200 ft

LEVEL OF EFFORT AND PERIOD OF PERFORMANCE\*

The level of effort is estimated to be 2-1/2 staff years over a 27 month period.

<u>FY 81</u>	<u>FY 82</u>	<u>FY 83</u>
1/2*	1	1

<u>Expertise needed</u>	<u>Relative Time Required</u>
Thermodynamics	1/3
Physical Chemist	1/3
Fire Analyst	1/3

#### REPORTING REQUIREMENTS

Reporting requirements for the respective tasks are as follows:

- Task 1. Following development and approval of the DBA's for the different types of research and test reactors, submit a report containing the results.
- Task 2. Following analyses of melting and fission product release and transport from Argonaut, TRIGAs, Pool and Tank type reactors, a report shall be submitted.
- Task 3. As part of the reporting requirements under Task 2, include the threshold operating limitations within which fuel elements or cladding melting cannot occur.
- Task 4. Following analyses of those reactors that are or may be subject to seismic induced accidents, report on temperature profiles of fuels and cladding that are crushed horizontally and vertically. A report shall be prepared for each reactor type.
- Task 5. A report shall be prepared for impact of fires on core damage for each reactor type.
- Task 6. Following completion of all the subelements in this task, prepare a report for MTR fuels and TRIGA fuels for fission product equilibrium conditions and for a family of reactor utilization factors suggested by Task 3.
- Task 7. As part of the report associated with Task 6, provide a report on exposures to persons in and immediately outside of confinement/containment structures.

\*Prorated on basis of fiscal year remaining.



REPORTING REQUIREMENTS

A monthly business letter-report is to be submitted by the 15th of the month to the Cognizant NRR Manager, with copies to the Director, Division of Licensing; G. Lainas, DL, and B. Grenier, Technical Assistance Program Manager. These reports will contain as subheadings:

- a. A listing of the efforts completed during the period, any milestones reached, or if missed, an explanation provided;
- b. The amount of funds expended for both manpower and for computer services during the reporting period and the cumulative amounts for each task;
- c. Any problems, concerns or delays encountered or anticipated;
- d. A summary of the progress to date;
- e. Plans for the next reporting period.

MEETINGS AND TRAVEL

It is estimated that one trip for two persons will be required for each reactor type reviewed.

NRC-FURNISHED MATERIALS

Renewal application, including Safety Analysis Report for reactor types.