RECEIVED BY SAFER: 2/11/81

LETTER REPORT

February 12, 1981
Accession No.__________
Contractors Report No.__________

Contract Program or Project Title: Investigation of Accident-Induced Flow and Material Transport in Nuclear Facilities

Subject of this Document: Reporting for December 1980

Type of Document: Informal monthly progress report

Author(s): R. A. Martin; W. S. Gregory

Date of Document: January 28, 1981

Responsible NRC Individual and NRC Office or Division

G. S. Lewis, Systems Performance Research Branch, SAFER:RES

Prepared by
Los Alamos Scientific Laboratory
P. O. Box 1663
Los Alamos, NM 87545

Prepared for
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

NRC FIN NO. A7029

DISTRIBUTION
J. Ayer
A. Clark
P. Loysen
L. Rouse
M. Au
G. Kligfield
C. Nichols
D. Solberg

LETTER REPORT

University of California
LOS ALAMOS SCIENTIFIC LABORATORY
Post Office Box 1663 Los Alamos, New Mexico 87545

In reply refer to: WX-8-4022 (R673)
Mail stop: 928

January 28, 1981

Mr. G. S. Lewis
Systems Performance Branch
Division of Safeguards, Fuel Cycle
and Environmental Research
US Nuclear Regulatory Commission
MS 1130SS
Washington, DC 20555

Dear Lew:

SUBJECT: R673 MONTHLY STATUS REPORT FOR DECEMBER 1980--INVESTIGATION OF ACCIDENT-INDUCED FLOW AND MATERIAL TRANSPORT IN NUCLEAR FACILITIES

The monthly status report for December 1980 is enclosed. Please call if you have questions or need clarification.

Sincerely,

Dick

R. A. Martin

Bill

W. S. Gregory

RAM/WSG:jr

Enc: As cited above

Cys w/enc: P. C. Owzarski/J. Mishima, PNL
E. J. Frederick, ORNL
J. F. Jackson/R. A. Haarman, EP/NRC, MS 671
L. W. Hantel, WX-DO, MS 686
W. A. Bradley, WX-8, MS 928
P. K. Tang, WX-8, MS 928
J. W. Bolstad, WX-8, MS 928
R. D. Foster, WX-8, MS 928
R. W. Andrae, WX-8, MS 928
H. A. Lindberg, WX-8, MS 928
CRMO (2), MS 150
WX-8 File, MS 928

PROGRAM STATUS REPORT

TITLE: Investigation of Accident-Induced Flow and Material Transport in Nuclear Facilities

PROJECT NO: R673

FIN NO: A7029

CONTRACTOR: Los Alamos National Laboratory

MONTH COVERED: December 1980

BUDGET STATUS: Annual Budget $485 k (includes FY 1980 carryover of $85 k)

Monthly spending	:	$ 81.5 k
Cumulative Spending	:	$149.2 k
Funds Remaining	:	$335.8 k

I. PROGRAM DESCRIPTION

The objective of this research is to develop the capability to predict accident-induced flow and material transport within a fuel-cycle facility. We will develop techniques and conduct experiments to provide supportive data for transport of internal accident releases throughout a facility. The program will be limited to providing source-term characterization at a plant's atmospheric boundary. The primary pathway to the atmosphere is a facility's ventilation system, and techniques developed in this investigation will be designed for, but not limited to, ventilation system pathways. Level One accident analysis computer codes for fire, explosion, and tornado will be developed this fiscal year. We will perform tasks in the analytical and experimental areas to support these program deliverables. As required, we will provide the necessary support to design and provide data for an accident analysis user's handbook.

II. HIGHLIGHTS/SIGNIFICANT MONTHLY ACTIVITIES

Fire Code Development - We have initiated the inclusion of an implicit gas species transport model in the EVENT Code. A rudimentary first model has been incorporated into the code, and this model has been partially verified as described below.

This gas species transport model appears to be satisfactory because its implicitness allows time step sizes at least as large as those allowed by the gas dynamics model. That is, the gas species transport model will not limit the time step size of the code. Furthermore, the verification studies reported below are encouraging because they show for the first time that we may be able to simulate long time, slow transients in a reasonable amount of computer time using the EVENT computer code algorithm as the basic gas dynamics model.

Fire Code Developmental Verification - We performed two computer calculations to compare EVENT-predicted results with existing results reported by others and obtained with a completely different computer code. Specifically, two scenarios have been analyzed.

The steady-state pressure, flow, and methane distribution in a large, interconnected system with 2 blowers, 51 branches, 32 nodes and 24 distributed methane sources have been obtained.

The calculated transient flow coastdown and resulting methane buildup from a blower failure (one of two in the system) have been simulated for 2 days of real time. For this transient, we were able to use 500-s time step sizes and simulate 1 day of real time in 1.6 s of computer time.

Fire Experiments - We are concerned about the filter-weighing problem and are giving much thought to using a null balance technique as opposed to using a scale. The advantage of a null balance technique would be the ability to detect a 1-g change out of several hundred grams as opposed to 1 g out of 16 000 g for the full weight of a filter. We are also considering loading 8- by 8-in. filters instead of 12- by 12-in. filters to reduce the loading time and the quantity of loading material as well as other apparatus costs. We will be specifying a gas analyzer sampling and analysis system soon.

Material Transport Modeling

- Convection Module - A different solution scheme is being implemented into the convection module. This new method applies an iteration procedure to check the mass balance, and it can handle steady-state cases. Previously, the steady-state material transport required a lengthy run of the program to reach an asymptotic condition. This technique is still under development.

- Source/Sink Modules - We have performed numerous hand calculations to compare aerosol deposition flux by gravitational setting and turbulent inertial deposition for varying particle size, specific gravity, flow velocity, and duct length. We will be working on incorporating these equations into the fire, explosion, and tornado codes.

Material Transport Experiments - We are reducing data obtained in our molybdenum powder (density = 10.2 g/cm^3) tests for centerline flow velocities of 7, 10, 13 and 15 m/s. We are concentrating on runs 12 through 16. At this time, the masses of aerosol collected at our five vertical sampling locations look fairly consistent with increasing height and speed.

The data will be further analyzed by a scanning electron microscope for particle size distribution calculation. We will compute horizontal and vertical flux and resuspension rate.

Explosion Code Development - The computer code is being streamlined to reduce storage requirements and features that were needed in the early development stages. We will continue this process to improve the efficiency of the code.

A zoom option has been added to EVENT that permits a very detailed solution of any portion of a system without having to include this amount of detail in the overall solution. The detailed solution is handled as a separate problem that uses boundary conditions previously established in a coarse overall mesh. This technique should be useful in analyzing large systems by reducing the problem size of any single solution. It will definitely be needed in the future to establish boundary conditions for the near-field analyses.

Fuel Facility Model - Work continued on evaluating various fuel facilities for the purpose of defining systems common to those facilities. These common systems will be used in a fire, explosion, and tornado analysis.

We have concluded that the AGNES facility and the Westinghouse facility will require models that are too large for use in the accident analysis handbook. Therefore we are considering a smaller, yet representative, model that could be used to design illustrative examples for the handbook.

Wind Tunnel Facility - The complete wind tunnel has arrived at New Mexico State University (NMSU) and will be stored until the new 120- by 70-ft building is constructed. Our estimate for completion of the building is the end of March 1981. Meanwhile, we will continue our material transport experiments and instrumentation development in the small wind tunnel at Los Alamos group H-5.

III. PROGRAM DEVELOPMENT VARIANCE

We are approximately 1 month behind schedule for task C.1, Define/Design Example Facility (Fig. 1). This delay stems from our assessment of the task and the decision to develop an alternative model for review in February 1981.

IV. BUDGET VARIANCE

Our operating costs are quite close to the planned schedule shown in Fig. 2. We still have not made a commitment on our capital equipment budget (Fig. 3), but we want to insure that the proper instrumentation is bought and effectively used. Our agreement with NMSU to buy complementary equipment items will allow us to make our purchases next month.

V. PROBLEMS AND ISSUES

A potential problem for Los Alamos is not receiving the required information from Pacific Northwest Laboratories (PNL) and Oak Ridge National Laboratory (ORNL) to design the example fuel cycle facility for the accident analysis handbook. We need, as early as possible, information that relates to the general aspects of the vent systems in fuel fabrication and fuel reprocessing facilities. We are looking for representative items. For example, do the vent systems usually have multiple supply and exhaust fans? does the flow go from least contaminated to more contaminated zones? are there usually large filter plenums? and so on.

Following receipt of this information, we will need detailed physical information concerning PNL's and ORNL's chosen accident scenarios. We will modify the example fuel facility to accommodate these scenarios.

FY 1981 PROGRAM DEVELOPMENT SCHEDULE

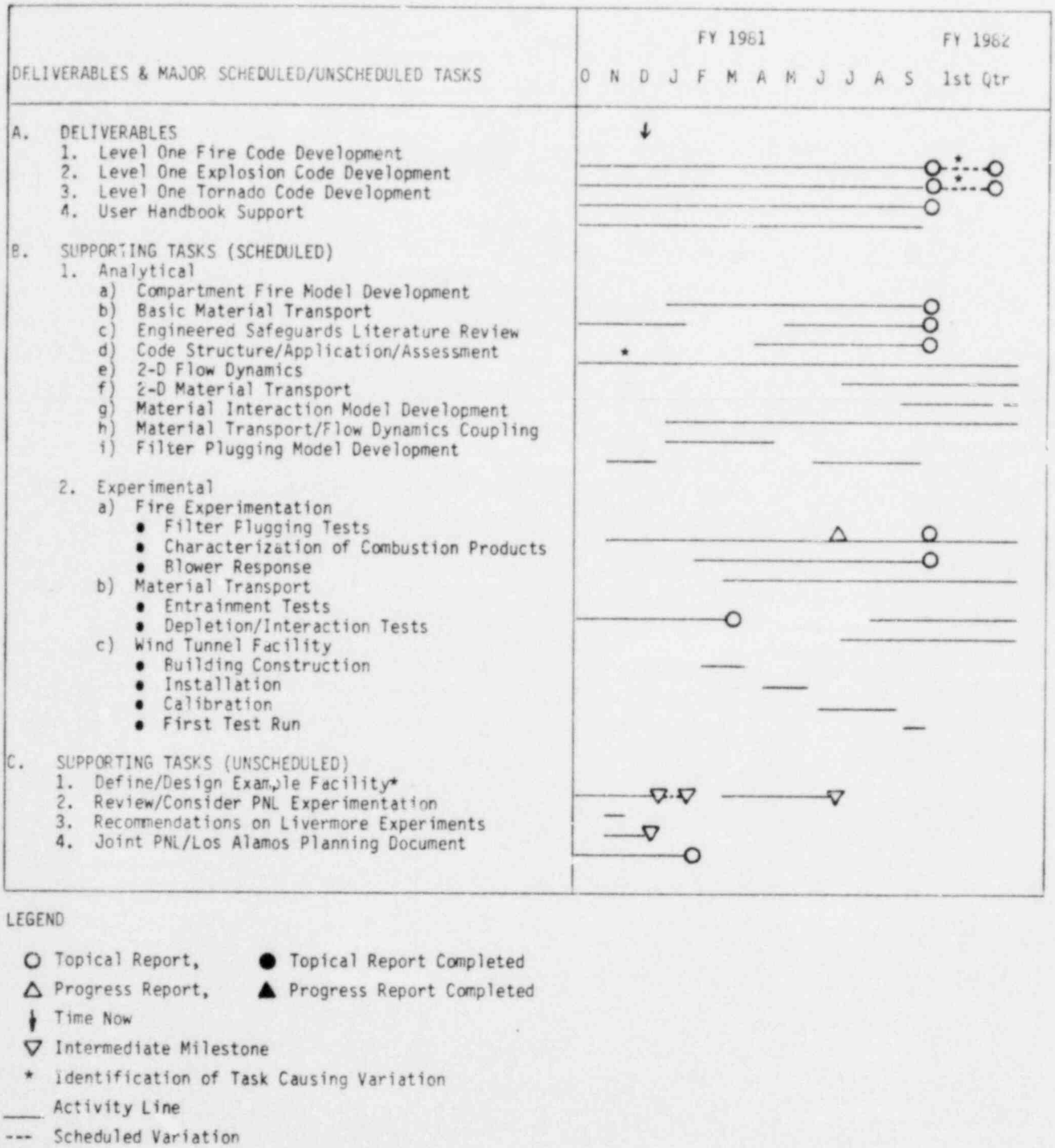
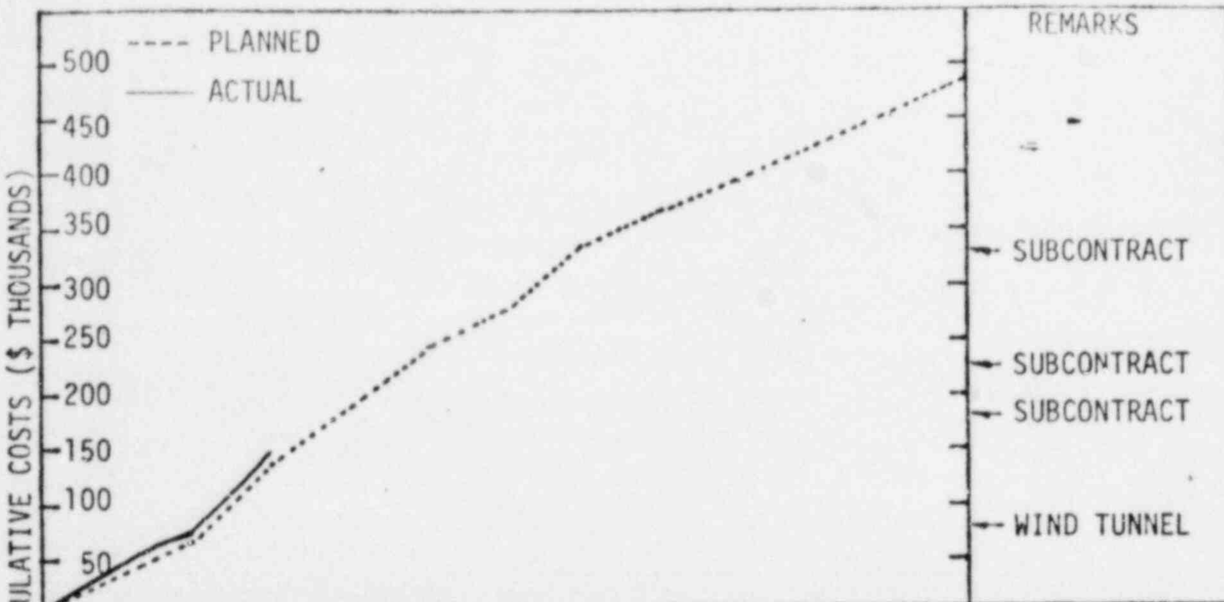


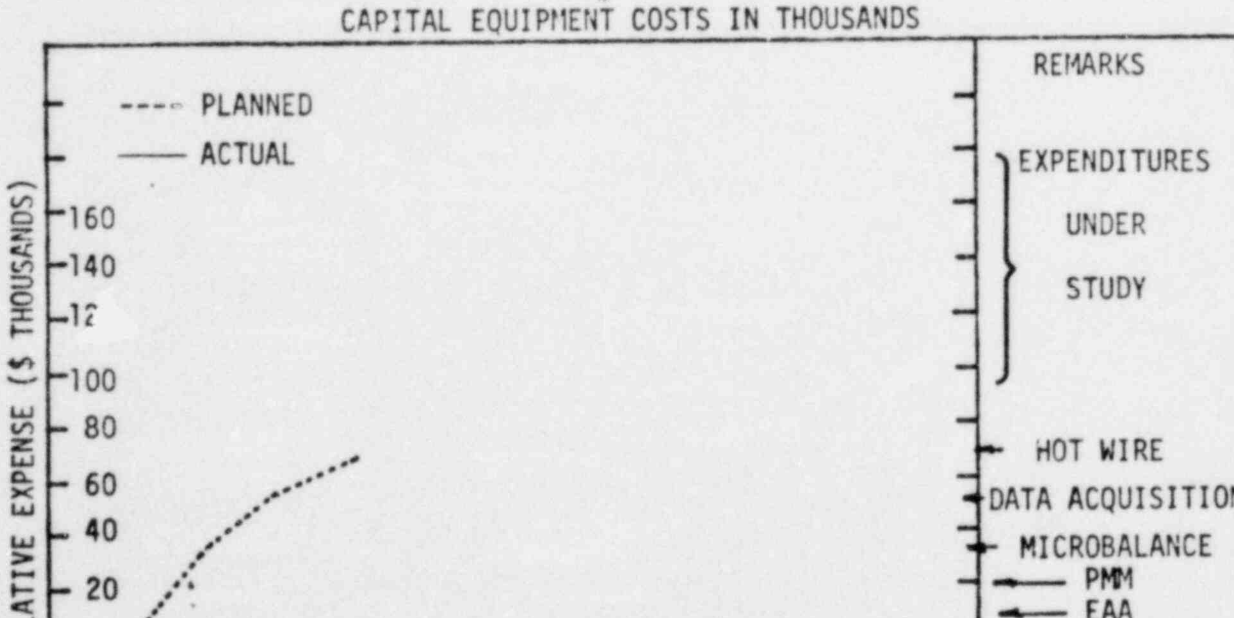
Fig. 1.

Fig. 2.
OPERATING COSTS IN THOUSANDS



30	60	135	185	240	270	330	360	390	420	450	485	PLANNED
34.5	67.7	149.2										ACTUAL
(4.5)	(7.7)	(14.2)										VARIANCE (OVER)
O	N	D	J	F	M	A	M	J	J	A	S	MONTH

Fig. 3.
CAPITAL EQUIPMENT COSTS IN THOUSANDS



0	33	56	63									PLANNED
0	0	0										ACTUAL
0	33	56										VARIANCE (OVER)
0	N	D	J	F	M	A	M	J	J	A	S	MONTH