BY THE COMPTROLLER GENERAL OF THE UNITED STATES

Poor Management Of A Nuclear Light Water Reactor Safety Project

Energy Research and Development Administration

Nuclear Regulatory Commission

The Plenum Fill Experiment is a light-water reactor test facility designed to help determine the effectiveness of emergency core cooling systems during the first stages of a loss-of-coolant accident.

Because of past mismanagement the project cost increased significantly and was canceled. The Commission is planning a new Plenum Fill Experiment project with some of the same mistakes repeated.

The Joint Committee on Atomic Energy should require the Commisson to justify and explain fully its approach for obtaining information from this project before authorizing it any additional funds.

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COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

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To the President of the Senate and the
Speaker of the House of Representatives

This report summarizes the deficiencies in the past management and the current approach of the Plenum Fill Experiment, a Nuclear Regulatory Commission reactor safety test project.

We made our review pursuant to the Budget and Accounting Act of 1921 (31 U.S.C. 53) and the Accounting and Auditing Act of 1950 (31 U.S.C. 67).

We are sending copies of this report to the Director, Office of Management and Budget; the Administrator, Energy Research and Development Administration; and the Chairman, Nuclear Regulatory Commission.

Comptroller General
of the United States

C O N T E N T S

ABBREVIATIONS

AEC	Atomic Energy Commission
ERDA	Energy Research and Development Administration
GAO	General Accounting Office
LOFT	Loss-of-Fluid-Test facility
NRC	Nuclear Regulatory Commission
PFE	Plenum Fill Experiment

COMPTROLLER GENERAL'S
REPORT TO THE CONGRESS

POOR MANAGEMENT OF A NUCLEAR LIGHT WATER REACTOR SAFETY PROJECT

Energy Research and Development Administration
Nuclear Regulatory Commission

D I G E S T

The Plenum Fill Experiment, a Nuclear Regulatory Commission reactor safety test project, is supposed to tell the Commission whether its licensing regulations for emergency core cooling systems and reactor power outputs are too stringent.

At the start the experiment was estimated to cost $1.8 million, but current estimates are $36 million. (See p. 3.) About $7.4 million has been spent to date to arrive at a detailed design. Some construction has taken place and about 60 percent of the required equipment either has been purchased or ordered. (See p. 11.)

The Nuclear Regulatory Commission terminated the experiment on July 1, 1976. It was dissatisfied with the experimental capabilities of the current system and with the Energy Research and Development Administration's contractor. (See p. 7.) The cancelled project involves a waste of about $5 million. (See p. 11.)

The Plenum Fill Experiment was plagued by management deficiencies. Among these was the failure of all parties involved to agree upon firm program requirements. This resulted in a detailed design which did not meet Nuclear Regulatory Commission requirements. (See p. 4.)

The Commission and the Energy Research and Development Administration also failed to (1) establish firm baseline designs and (2) control design changes. Instead, the project was designed and redesigned as it was being constructed. (See p. 18.)

The two agencies did not adequately define their respective management roles and responsibilities.

Consequently, the project was poorly managed by both the Commission and the Energy Research and Development Administration. There are some indications that the two agencies are having problems developing suitable arrangements to jointly manage research facilities. (See p. 7.)

The Congress was not advised until recently of the Plenum Fill Experiment or its large cost growth primarily because of the way the project was funded. (See p. 19.)

The Nuclear Regulatory Commission now plans to have a similar facility constructed. This new one is expected to cost at least $40 million to construct and operate. (See p. 10.) Such an experiment is important to reactor safety and nuclear power, but GAO is not convinced that the Commission's approach to building another such facility is sound. In fact, the Commission is in the act of repeating some of the same mistakes that led to cancellation of the original project. (See p. 19.)

RECOMMENDATIONS TO THE CHAIRMAN, NUCLEAR REGULATORY COMMISSION

The Chairman should

--postpone all decisions on the new project until a conceptual design is completed which provides a realistic scope, schedule, and total estimated cost, and until an agreement is reached with the Energy Research and Development Administration for managing the project as well as future reactor safety projects (see p. 21),

--institute measures to hold to a minimum the use of operating appropriations for construction activities, and

--alert the Congress to any construction activities for which more than $1 million of operating appropriations is obligated.

RECOMMENDATIONS TO THE ADMINISTRATOR, ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

The Administrator should

--reach an agreement with the Commission for managing the new Plenum Fill Experiment as well as the future reactor safety projects,

--begin steps to minimize the use of operating appropriations for construction activities, and

--alert the Congress to any construction activities for which more than $1 million of operating appropriations is obligated. (See p. 21.)

RECOMMENDATIONS TO THE JOINT COMMITTEE ON ATOMIC ENERGY

The Joint Committee should

--require the Nuclear Regulatory Commission to prepare a conceptual design, justify and explain its approach for the new Plenum Fill Experment, and reach an agreement with the Energy Research and Development Administration for managing reactor safety research projects before authorizing any additional funds for a new project (see p. 21) and

--require the Nuclear Regulatory Commission and the Energy Research and Development Administration to minimize the use of operating appropriations for construction and to alert the Joint Committee to any construction activities for which more than $1 million of operating appropriations is obligated.

AGENCY COMMENTS ON THE DRAFT REPORT

The Commission objected to GAO's conclusion that the Commission, in planning for a new experiment, was making many of the same mistakes that it had made on the cancelled one. In particular, the Commission cited its current plan to complete a conceptual design study before it decides to go forward with the project.

GAO agrees with this approach but points out that it is a recent development brought about by congressional interest in the project and the Energy Research and Development Administration's refusal to fund the project's

construction and to agree that the Commission could use its Lawrence Livermore Laboratory (See p. 22.)

The Commission also disagreed with the conclusion that its relationship with the Energy Research and Development Administration was not improving. GAO points out that the two agencies still have not reached agreement for the design, construction, and operation of a new Plenum Fill Experiment and that a Commission internal audit report identifies several difficulties between the agencies. (See p. 23.)

The Energy Research and Development Administration's main concern was on GAO's recommendation that the Administration minimize the use of operating funds for construction activities. The Administration believes its current procedures and controls are adequate.

GAO does not disagree with the Administration's overall policy of funding short-lived projects with operating funds but it believes that some formal reporting system must be developed to assure that the Congress is kept informed. (See p. 24.)

The Administration also disagrees with GAO's conclusion that the cancelled project involved a waste of about $5 million. The Administration believes that some value can be placed on the research and development activities which were conducted over the life of the project.

GAO believes that an undetermined value can be placed on the research efforts, but that some or perhaps all of this value could be offset by the cost of procured but unusable Plenum Fill Experiment equipment. (See p. 25.)

CHAPTER 1

INTRODUCTION

One of the worst accidents that could occur to a nuclear light water reactor is the failure of its primary cooling system. This could occur if a major pipe broke allowing the water to escape from the reactor core where the nuclear fuel is located.

Reactors are designed to quickly stop the fissioning or chain reaction, but, in the absence of continued cooling, enough heat would be present and generated in the fuel to eventually melt the core. If a series of unlikely events takes place, a core melt could potentially lead to the breach of the building containing the reactor and to the release of large amounts of radioactivity to the atmosphere. Although the destruction that would follow is not clear, it is generally believed that an uncontrolled release of radioactivity into the atmosphere could destroy many lives and much property.

To prevent a core from melting, reactors have emergency core cooling systems which are designed to quickly provide enough replacement water to keep fuel at a safe temperature. Although these systems undergo testing before the insertion of the nuclear fuel in each commercial powerplant, large scale tests to demonstrate their ability to function properly in an accident situation have not been conducted.

In 1972, a contractor to the Atomic Energy Commission (AEC)--Battelle, Pacific Northwest Laboratories--proposed to conduct an experiment that could help test the performance of emergency core cooling systems. AEC approved the experiment, now called the Plenum Fill Experiment (PFE). Although AEC was abolished in January 1975, the project has been continued by the two successor agencies--the Nuclear Regulatory Commission (NRC) and the Energy Research and Development Administration (ERDA). NRC has been directing the technical aspects of the project while it is being built at an ERDA laboratory by an ERDA contractor 1/. Since the reorganization of AEC, NRC has been funding the project.

1/ The Energy Reorganization Act of 1974 (Public Law 93-438) which abolished the AEC, transferred the AEC laboratories and contractors to ERDA but directed the Administrator of ERDA and the heads of other Federal agencies to cooperate with and provide services to NRC.

The original PFE experiment, which was to be built at ERDA's Hanford Reservation close to Richland, Washington, had an estimated cost of $1.8 million--equivalent to $2.4 million in constant 1976 dollars 1/--and was to be finished in May 1974. However, because of changes in scope, and various management and technical problems, the project cost and schedule increased significantly.

After over $7.4 million ($8.1 million in 1976 dollars) and about 4 years were spent on the project, NRC concluded that the project would not satisfy its needs and abandoned it in its present form. It now plans to begin a new project using another ERDA laboratory.

These problems raise questions as to how the project originated and evolved, the competency of agency and contractor management, and the adequacy of NRC and ERDA working relationships. The following chapter addresses these questions and describes the current status of the project.

1/ All historical numbers and current estimates in this report are shown in terms of their original dollar estimate or cost and our estimates of their constant 1976 dollar equivalency.

CHAPTER 2

INADEQUATE MANAGEMENT OF THE PLENUM FILL EXPERIMENT

The PFE project experienced large cost growth and schedule slippages while in progress. Its estimated costs have increased from $1.8 million ($2.4 million in 1976 dollars) to approximately $36 million ($32.8 million in 1976 dollars); the scheduled start of the experimental test runs has slipped from January 1974 to May 1979; and the scheduled completion of the tests has slipped about 6 years.

FAILURE TO ADEQUATELY EVALUATE THE ORIGINAL PROPOSAL

The PFE began in August 1972, when an AEC contractor proposed to AEC's Division of Reactor Development and Technology to perform research on the behavior of emergency cooling water during a loss-of-coolant accident. The proposal suggested using various existing Government furnished equipment, including a water supply system, a steam supply system, two vessels to simulate reactor vessels (one vessel was about one-fifth and the other about four-fifths the size of a nuclear reactor vessel), buildings, and other equipment. The proposed research program consisted of 40 tests to be run over a 4- to 6-month time period. Not all of the possible conditions which could occur during a loss-of-coolant accident were to be tested--just those conditions the Government-furnished equipment could simulate. The contractor estimated it could use the existing equipment to construct the project and perform the test runs within 22 months for about $1.8 million ($2.4 million in 1976 dollars).

In March 1973, after raising some technical questions and receiving a revised contractor proposal, AEC approved the project's scope and requirements at an estimated cost of $2.1 million ($2.6 million in 1976 dollars). Because of the project's relatively small scope and limited test program, AEC funded PFE from its operating appropriation. This was in accordance with AEC procedures, which permitted experiments with a useful life of less than 3 years to be funded from operating expense appropriations. Since the experimental test program never exceeded 3 years, AEC and NRC continued to fund the project from the operating appropriation even though its costs grew substantially.

In the summer of 1973, the contractor found that some of the Government-furnished equipment needed more refurbishment than anticipated. This included extensive overhauling

of boiler feed water pumps and coal handling facilities in the steam plant. Progress on the project's design also began to slow down and by February 1974, the estimated cost had increased to $4.7 million ($5.6 million in 1976 dollars).

Also in 1974, a newly formed AEC division which is now part of NRC--Reactor Safety Research--stopped renovation of the steam plant and directed that new boilers be purchased to provide the steam to run the experiments. In addition, the proposed test period was extended to 9 months. These and other changes increased the estimated project cost to $14.7 million ($16.6 million in 1976 dollars).

During 1975, further problems with the design and the Government-furnished equipment were identified and the testing program was expanded. As a result, in April 1976 the estimated cost to complete the project had grown to $36 million ($32.8 million in 1976 dollars). (See app. I.)

FAILURE TO AGREE ON PROJECT REQUIREMENTS AND DESIGN

In mid-1973, the contractor completed a description of the overall PFE design and a work plan for accomplishing the project. Soon after, however, meetings were held among the contractor, reactor manufacturer representatives, and the personnel of the new Division of Reactor Safety Research which resulted in modifications to the scope of the research program to obtain experimental data more applicable to what actually occurs during a loss-of-coolant accident in a nuclear power reactor.

In June 1974, the contractor developed design criteria for the PFE facility which described the (1) equipment and facilities to be fabricated and constructed, (2) building, piping, and vessel codes to be employed, (3) thermal and hydraulic conditions to be encountered during testing, and (4) Government-furnished equipment and facilities to be used. After some modification, the AEC field office--Richland Operations Office--approved the design criteria as a basis for continuing the PFE project. Reactor Safety Research gave approval to the criteria--conditional on the contractor preparing an assessment of the facility's capability.

Soon after, a Reactor Safety Research consultant recommended changes to the planned instrumentation to allow for better and more extensive data collection. Also, Reactor Safety Research officials believed that the contractor's

stress analysis 1/ and related design of the PFE piping system were inadequate and needed more work. Therefore, on November 21, 1974, Reactor Safety Research provided the contractor with guidelines which defined the major results expected from the PFE program, the type of tests required, and the instrumentation needed to record the test data. The contractor told Reactor Safety Research, however, that these guidelines did not adequately define the specific tests and the types of data wanted and that there was uncertainty as to whether all the tests could be performed.

In April 1975, Reactor Safety Research (at that time, part of NRC) gave the contractor approval to complete the PFE detailed design and to determine its testing capabilities even though Reactor Safety Research should have recognized at that time that the design would probably not fully meet the November 1974 guidelines. NRC officials told us they could not recognize this because the contractor and the Richland Operations Office were not responsive to NRC questions and requests.

The contractor analysis, which was not completed until March 1976, concluded that the facility would meet or exceed Reactor Safety Research's requirements with only two exceptions. First, because of inadequate steam supply, some tests using the large simulator vessel could not be run for the full range of test conditions for the specified time period. Second, the simulated reactor vessel would not be adequately responsive to changing water levels. The contractor also reported that the PFE facility could perform 103 of the 110 tests required by Reactor Safety Research's recently defined test program. Reactor Safety Research disagreed. While the anticipated performance of the 1/5-scale-vessel was acceptable, NRC believed that only a small fraction of its performance requirements could be achieved in the larger 4/5's-vessel tests.

FAILURE TO ACT ON ALLEGEDLY POOR CONTRACTOR PERFORMANCE

In the area of large scale planning and management of the PFE project, NRC rated the contractor's performance from marginal to unsatisfactory. It should be pointed out, however, that the contractor's performance on the many other jobs it performs for ERDA and NRC has been judged to be from

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1/ Analysis to determine whether the vessels, vessel nozzles, and piping can handle the severe water and steam forces expected during the normal operation of the facility.

satisfactory to very good by ERDA. The first indication of concern about the adequacy of the contractor's capabilities to manage large scale experimental programs came in early 1974 when the Richland Operations Office reported to Reactor Safety Research that the contractor did not have sufficient management involvement in PFE or extensive experience with programs which required project management responsibilities.

In July 1974, the Richland Operations Office reported to Reactor Safety Research that (1) when Richland Operations Office became involved in the project in early 1974, there had been a definite lack of management control in the program and considerable effort had been made to improve this area and (2) both the contractor and Richland Operations Office recognized the need for good project control and believed significant improvement had been made in this area. An AEC headquarter's office reported, however, that the planning, scheduling, and control on PFE was not adequate to manage the project in a responsible fashion. This concern was also expressed by a Reactor Safety Research official in a July 1974 project review trip report when he stated that the contractor had not shown evidence of being able to effectively manage the project. He also stated that AEC headquarters would need to provide the leadership and probably the direction to turn the program into a suitably managed project.

In an October 1974 request for a project review meeting with the Richland Operations Office and the PFE contractor, Reactor Safety Research noted its continuing concern about the program management, schedule control, planned expenditures, and commitment of adequate manpower to the project. In response, the Richland Operations Office reported that the contractor had successfully recruited more manpower to improve its planning and operations.

In April 1975, concern with the adequacy of the contractor's management surfaced again at a project review meeting. In response, the contractor prepared a project management plan and made organizational and personnel changes to strengthen its management activities. However, in June 1975, Reactor Safety Research reported to ERDA that the overall performance of the contractor during fiscal year 1975 on the PFE program ranged from marginal to unsatisfactory. The report mentioned that the contractor's

> "* * * primary problems appear to stem from their incapability to plan, cost, and schedule, and manage a major project directed at producing a large, complex experiment facility which will initially be subjected to construction constraints

but at the same time provide for considerable testing flexibility * * *."

In a trip report of an August 1975 project review meeting, the Richland Operations Office noted that Reactor Safety Research expressed extreme displeasure and a basic lack of confidence with the contractor's management of the PFE project. In September 1975, a joint NRC and ERDA investigation of the project emphasized that the contractor's management performance was poor. Another joint NRC and ERDA investigation, conducted in November 1975, concluded again that the contractor (1) did not know how to adequately design, engineer, and construct a large test facility, (2) lacked experience in project management, (3) had been unable to secure competent management, (4) failed to obtain required approvals, (5) failed to implement required management controls and procedures, and (6) had questionable technical competency. In addition, NRC officials directly responsible for the project told us that the contractor was incompetent and had serious technical and management deficiencies.

The contractor, however, told us that it had never received a copy of the above mentioned NRC/ERDA investigation reports or the August 1975 trip report. The contractor's representatives said, in commenting on this report, that they did not agree with the above conclusions about its performance and, in fact, believed them to be misleading since Battelle, Pacific Northwest Laboratories was not directly responsible for part of the design or any of the construction activities on PFE. These activities were handled by other organizations under direct contract with ERDA.

Finally, on July 1, 1976--some 29 months after the first indications of concern with the contractor's progress on the project--NRC requested that ERDA terminate the current PFE project. This decision was being considered in late 1975 but Reactor Safety Research requested that the contractor finish the PFE capability analysis and detailed design--at an additional cost of about $1 million in current 1976 dollars. Reactor Safety Research believed this to be necessary so that it could better determine whether to continue with the project at Richland or move the experiment to a different location and contractor.

FAILURE TO DEVELOP FEDERAL HEADQUARTERS AND FIELD OFFICE MANAGEMENT ROLES

When the project began, it was under the direction of the AEC Division of Reactor Development and Technology, which managed the project through its own site office at Richland. The Richland Operations Office was merely a

contract administrator insuring that funds were spent as budgeted. In mid-1973 when the project was transferred to the newly created Division of Reactor Safety Research, the new Division Director said that he intended to place greater reliance on management services provided by the field operations offices instead of site offices such as those used by the Division of Reactor Development and Technology.

Specific management roles, however, were not adequately identified or assigned. This contributed to disagreement and misunderstanding by the organizations involved, including the Richland Operations Office and the contractor, as to their responsibilities and authority in such areas as

--defining the project scope, schedule, and funding levels,

--administering, controlling, and approving the contractor's design and construction activities, and

--operating the constructed facilities.

POOR NRC AND ERDA RELATIONSHIPS

Before AEC was abolished in January 1975, NRC and ERDA staffs had already begun working informally on interagency agreements for those projects to be owned by ERDA but primarily used by NRC. The first priority was an agreement on the Loss-of-Fluid-Test (LOFT) 1/ facility since it was the major light water reactor safety test facility. All other agreements were to be modeled after LOFT.

The two agencies, however, had difficulty in reaching an agreement on LOFT because

--ERDA felt that it had potential use for LOFT and did not want to give complete control to NRC,

--NRC felt that it must independently establish the LOFT technical requirements and assure that they were met and did not want ERDA to interject its technical opinions in this process, and

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1/ LOFT is the subject of a GAO report entitled "This Country's Most Expensive Light Water Reactor Safety Project" (RED-76-68, May 26, 1976). Also, a March 10, 1976, report to the Senate Committee on Government Operations discusses the ERDA/NRC attempts to reach agreements for managing projects.

--ERDA, as the owner and contract administrator, believed that it must maintain sufficient control of the project to assure that all tests were safely conducted within the contractor's scope, schedule, and cost.

It was not until August 1975 that a document, called a memorandum of understanding, was signed by both agencies establishing a working relationship for managing LOFT.

The memorandum gave responsibility for the programmatic direction of the project to NRC, but recognized the management responsibilities of ERDA. However, it left some important detailed management relationships and responsibilities undefined which resulted in differences in interpretations between NRC and ERDA. Certain funding and management relationships are still undefined and since LOFT was to be a model for other safety related projects, this affected the management of PFE.

NRC and ERDA did not adopt an interagency agreement defining their respective responsibilities and authority for the PFE project. At first this was held up pending an agreement on LOFT, but in late 1975 all negotiations were terminated because of the potential that PFE would be cancelled, significantly changed, or moved to another location.

Consequently, we found that NRC attempted to manage the project from its headquarters in Washington, D.C., through periodic project meetings and correspondence. This tended to compound the confusion over management responsibilities.

Funding for the PFE project

The PFE project was originated and funded by AEC, but, as a result of the Energy Reorganization Act of 1974, it became part of NRC's Light Water Reactor Safety Program. Through fiscal year 1976, NRC funded the program and ERDA performed the work on a reimburseable basis.

A recent agreement between the controllers of the two agencies established the following funding policy for NRC/ERDA projects. "Subject to appropriate agreement between the agencies, ERDA will budget for and manage the construction and equipping of facilities required for the NRC Confirmatory Assessment Program at ERDA sites. Once the facility has been completed and made available to NRC for use, NRC will fund for the operation of the facility and any special equipment items which are required for the Confirmatory Assessment Program." NRC, therefore, assumed that ERDA would fund the PFE project beginning in fiscal year 1977. However, because ERDA is not in control of the requirements and design of PFE, ERDA notified NRC that it will not accept an open-ended

funding arrangement on PFE and will not provide additional funds beyond the $5.5 million budgeted by ERDA in 1977. Also, ERDA says that funds appropriated for the cancelled PFE project cannot be used in a replacement facility without congressional approval. In addition, ERDA's officials have now indicated that NRC should budget for the entire cost of a new PFE facility with ERDA providing the management services on a reimburseable basis. These arrangements are subject to further negotiation between NRC and ERDA.

CURRENT STATUS

Reactor Safety Research now proposes a new research program using a 1/3-scale or larger facility in lieu of the cancelled 1/5- to 4/5-scale tests. It has determined that a 1/3-scale is the minimum size that the facility can be built and still be representative of full size commercial reactors.

In March 1976, NRC solicited proposals from five ERDA laboratories for a 1/3-scale test facility--Sandia, Livermore, Battelle/Richland, Oak Ridge, and Savannah River. NRC received these proposals by April 12, 1976. The Sandia and Livermore laboratories have access to existing commercial steam supplies and were selected as the best possible contractors. More steam is available at the Livermore site 1/ than necessary for tests on a 1/3-scale facility so NRC is entertaining the idea of increasing the scale of the new facility to one-half or larger, depending on the volume of steam actually available.

NRC has estimated that a new 1/3-scale facility, if located at the Livermore site, will cost about $31 million ($26 million in 1976 dollars) to construct. If a larger scale facility is built to use the huge steam supply, the estimate increases to $38 million ($32 million in 1976 dollars). An additional $5 to $6 million ($4 to $5 million in 1976 dollars) per year for about 2 years would be needed to run the test program in either facility. NRC based these estimates on the 1/3-scale cost proposals it received from the laboratories (see table 1) plus a cost analysis that an ERDA contractor made for NRC. At best, the laboratory estimates are very preliminary. Oak Ridge refused to submit an estimated cost proposal because of the limited time NRC gave for its preparation. In addition, NRC increased the Livermore estimate from $17 to $31 million ($14 to $26 million in 1976 dollars) because it felt the estimate was far too

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1/ Livermore proposed placing the experiment at a site adjacent to a privately owned steam plant some 35 miles from the Livermore laboratory.

low. Except for Battelle, none of the laboratories has experience in designing and building a PFE type facility, although each has other construction experience. As of August 1, 1976, NRC had not formally selected a site although it was leaning heavily towards locating the facility at the Livermore site and using Livermore personnel to design, construct, and operate the facility.

As of July 1, 1976, about $7.4 million had been spent on the cancelled project. Of this total, about $2 million was for procurement. This plus about $500,000 of outstanding purchase orders represented about 60 percent of all materials to have been purchased. NRC has not yet determined how much of this equipment will be reusable on the new project. Therefore, since about $2.5 million represents potentially reusable items, the total expenditure of about $7.4 million includes a waste of about $5 million 1/ of Federal funds. Continuing under the present circumstances, however, could result in the waste of even more money, considering the many problems being experienced with this project.

1/ NRC and ERDA officials disagreed with this value on waste because they believe that some undetermined value could be placed on the stress analysis and the research and development performed as part of the project.

Table 1

Proposals for 1/3-Scale PFE Projects

Proposing ERDA laboratory	Construction costs in current 1976 dollars	Construction costs (includes escalation)	Test program costs in current 1976 dollars	Test program costs (includes escalation)	Earliest testing date	Estimated testing completion date
	(millions)					
Savannah River Laboratory	Not available	As high as $130	Not available	$9 to $17	Late 1981	None provided. Estimated that a 1-year design effort is needed before cost and schedule could be determined.
Oak Ridge National Laboratory	Not available	None provided	Not available	Not available	Stated that time did not permit good estimating.	
Lawrence Livermore Laboratory	$14	$16.6	$18.2	$23.4	Early 1979	Early 1984
Sandia Laboratory	$29.2	$33	$21.3	$33.6	December 1979	September 1983
Pacific Northwest Laboratory (Richland)	$26.2	$33	$16	$25	October 1981	---

CHAPTER 3

FUNDAMENTAL QUESTIONS SURROUNDING THE PFE

The action that NRC is taking on the PFE led us to reexamine some of the fundamental questions surrounding the PFE: Why is it seen necessary? What are the potential benefits? Would it provide greater assurance of reactor safety? What is the best scale to build? To help us deal with these questions, we engaged four consultants that had previously assisted us in our review of the LOFT facility (see app. II).

PURPOSE OF THE PFE

The general purpose of PFE is to determine how much of the injected emergency core cooling water is retained in a pressurized water reactor vessel during the period of time in a loss-of-coolant accident known as "blowdown." 1/ During this period, much of the normal cooling water inside the reactor is expected to be lost through the broken pipe. Initially the water rushes out of the break because it is under pressure. Then, as the pressure rapidly decreases, the water changes into steam and continues to rush out the break.

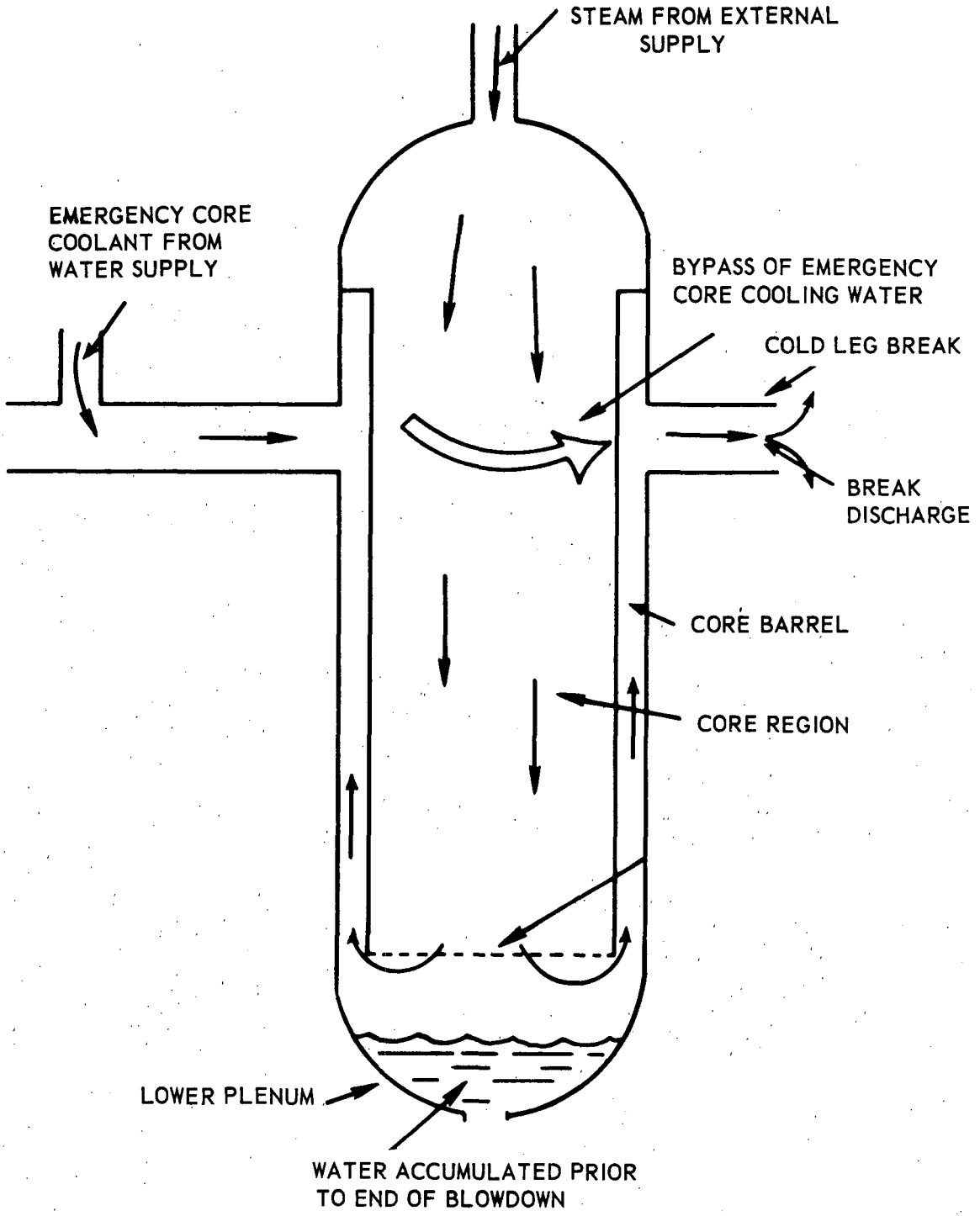
For pressurized water reactors, the emergency core cooling system is designed to start injecting emergency water when the internal pressure reaches about 600 pounds per square inch. A typical reactor will reach this point about 11 seconds after the break in the pipe. There is concern, however, that a significant amount of injected emergency cooling water might bypass the nuclear core and be swept out of the pipe break along with the hot reactor water and steam. (See fig. 1.)

For purposes of conservatism in the safety evaluation of nuclear powerplants, current NRC licensing regulations allow no credit for emergency water injected into the reactor vessel before the end of blowdown. Although current computer analysis techniques predict that some emergency water is retained in the reactor system during this period, NRC does not accept these predictions because of the lack of physical data to support its calculations.

1/ The time after a large primary coolant pipe break, during which the pressure inside the reactor vessel is reduced from its normal operating condition of about 2,200 pounds per square inch to about atmospheric pressure.

SCHEMATIC OF PLENUM FILL EXPERIMENT

The purpose of the experiment is to determine when the emergency core cooling water stops bypassing the core and starts filling the lower plenum part of the reactor vessel.



PFE is, therefore, an attempt to gather data by simulating what occurs during the blowdown phase of a loss-of-coolant accident.

If it could be determined that a significant amount of the emergency water is retained in the reactor vessel before the end of blowdown, less time would be required for the water to reach and cool the core. This could potentially permit reactors to be operated at higher fuel temperatures and power levels and would provide confirmation and quantification of the conservatism of present licensing requirements.

BENEFITS OF THE PFE

NRC recently identified three main benefits for the PFE project. One is a confirmation of the intended conservatism of its present licensing requirements. Since NRC does not allow credit for any emergency water injected in the reactor vessel during blowdown, any experimental proof that water actually accumulates during this period should confirm the conservatism of licensing regulations. NRC believes the public confidence that would be gained from this confirmation is one of PFE's most important benefits.

The second benefit is to provide a basis for modifying the present licensing requirements if emergency core cooling systems were proven effective during blowdown. NRC believes that this could result in increased power production of about 5 percent from the reactors, if other current limitations and restrictions are removed. However, there are no commercial reactors with restricted power levels which could increase their power if it could be shown that the emergency core cooling systems are effective during part of the blowdown phase. Even if other safety considerations should preclude an increase in the operating power levels, other design and operating benefits could result from assurances of improved use of emergency core cooling water. In addition, the PFE experimental results could provide a better understanding for future emergency core cooling system designs and for the interpretation of other reactor safety tests, such as those to be conducted on the LOFT facility.

The third benefit is to eliminate some uncertainties in the operation of nuclear reactors by gaining a better understanding of the bypassing phenomenon in large systems. The present understanding of the emergency core cooling water bypass is based on small-scale experiments. While these small tests have shown a mixing of emergency water and the reactor steam, a large system might experience

separated steam and water flows. If this were true, mathematical modeling techniques for emergency core cooling systems should be developed to account for this phenomena. The PFE program is the only presently planned large-scale demonstration of the bypass phenomena that can provide the basis for the understanding and modeling of bypass in large systems.

SCALE OF THE PFE FACILITY

PFE type experiments were conducted in past years on facilities that were one-thirtieth, one-fifteenth, and one-fifth the size of commercial nuclear reactors. The validity of the 1/5th-scale tests was not as sound as the others because it was not designed primarily to test the bypassing phenomenon. Using data from these tests to predict the behavior of full size reactors involves a great deal of uncertainty.

NRC officials have told us that based on their judgment and the scientific knowledge available, a 1/3-scale facility is the smallest facility that could produce information applicable to full size reactors. If the test results from this facility are similar to the previous 1/15- and 1/30-scale test data, these officials do not believe that extrapolation to full scale will be a problem although some uncertainty would remain as to the behavior of the full size system. If the test results are significantly different, NRC believes that sufficient data will be available to understand what happened and to provide a means to evaluate any larger size system.

The Director of NRC's Office of Nuclear Reactor Regulation told us that a 1/3-scale test may leave questions open as to the performance of full size reactors but that a larger scale facility (1/2-scale) has the potential to settle the question. If the emergency water bypasses the core in a 1/2-scale facility, then NRC would have greater assurance that it will bypass the core in a full size reactor. If the same thing happens in a 1/3-scale facility, questions might persist as to what happens in a full scale reactor, necessitating a yet larger scale test to settle the question.

It should be noted that the NRC decision on scaling is being greatly influenced by the capability of existing steam plants and not by any past experimental results or scientific data. One of our consultant's views on this point were expressed as follows:

> "I have not seen a valid engineering justification for the 1/3rd scale size as proposed by the NRC.

* * * In neither the first nor second GAO briefings 1/ was a technical reason given for this choice."

Another consultant said:

"With respect to the question of whether a one-third scale test is sufficient to permit extrapolation of test results to a full scale commercial reactor, the answer is that third scale tests seem to be too small. No definitive arguments have been given by the NRC for selection of one-third scale testing. Large scale, four-fifths tests were always given as evidence of NRC's recognition of the need for large scale results in certain critical areas of loss-of-coolant-accidents analysis."

1/ Two briefings were arranged for the consultants. At one, NRC made presentations on the PFE; at the other, representatives of private research groups made presentations on their 1/15th, 1/30th, and 1/5th and related experiments.

CHAPTER 4

CONCLUSIONS, OBSERVATIONS, RECOMMENDATIONS, AND AGENCY COMMENTS

We recognize that designing and constructing research type projects involves some inherent difficulties. But the cancelled PFE project was so badly carried out that it must be described as a clear example of mismanagement.

First of all, we found no evidence that the original proposal was adequately evaluated to determine if it could meet its stated objectives or if the estimated costs were reasonable. This situation was exemplified by the contractor's inability to use existing equipment as expected.

Second, the parties involved in the project never agreed to one set of project requirements and consequently never arrived at an acceptable baseline design from which the project could be controlled. Instead, as was also characteristic of the LOFT project, PFE's requirements were continually changed as it was being designed and fabricated. This led to the preparation of a detailed design which failed to meet NRC requirements.

Third, even though the contractor's ability to manage the design and fabrication of such a complex project was in question as early as July 1974, no effective action to improve, or decisive action to terminate, the project was taken until July 1976.

Finally, relationships within and between the Federal agencies involved in the project were either vague or undefined, leading to confusion on responsibilities.

To explain or excuse this mismanagement, one can point to internal AEC reorganizations--the splitting of AEC into ERDA and NRC and the attendant uncertainties and confusion as well as the alleged incompetence of the contractor. We believe, however, that the responsibility for this project and the waste of time and money that it involved must rest with the agencies that are spending Federal dollars and that have failed to exercise effective management controls.

Why didn't one of the groups or organizations in the Federal structure that control or have oversight responsibilities over spending--such as the AEC, ERDA, or NRC internal audit groups, the Office of Management and Budget, the Joint Committee on Atomic Energy or GAO--step in and question this project? The answer to this question is that

the extent of the problems on PFE was not known. This was partly the result of the way that PFE was funded both originally and even later when its cost estimate grew significantly. PFE was funded from operating rather than construction appropriations. It never appeared as a discrete item in any budget but was included in a general category called "separate effects testing." Therefore, specific funding authority for this project was not necessary and neither NRC nor ERDA advised the Congress or any other organization of the cost growths or other management problems.

Also, because operating funds were used, certain management controls which govern construction projects were not used. In short, the use of operating funds permitted circumventing some safeguards in the Federal spending system that might have prevented PFE from growing from a $2 million project to one with a $36 million price tag and the abandonment of the project involving a waste of $5 million.

Notwithstanding past management errors, we believe that research on the bypassing phenomenon is of sufficient value to justify its continuation. Information on the ability of emergency core cooling systems to supply water to the core region during the blowdown phase of a loss-of-coolant accident can help settle some basic questions about the adequacy of these safety systems. While most nuclear experts would agree that NRC's licensing basis is conservative and that reactors can withstand the worst credible accident conceived, enough doubt is expressed in certain segments of the scientific and public communities to justify this type of research. For example, a consultant to NRC recently charged that NRC placed too much reliance on computer simulation techniques and that these techniques are not necessarily conservative. He cited problems with the emergency core cooling system bypass phenomena and suggested that alternative emergency core cooling designs might alleviate this problem.

If nuclear power is to remain a viable power option, many of the unknowns about its safety margins must be investigated and quantified. The argument that nuclear powerplants have been built without full understanding of safety characteristics of the plant has merit and research must continue to provide the necessary information which can help put the safety questions in perspective. Hopefully, such research, carefully conceived, managed, and controlled could lead to a better social consensus about the relative safety of nuclear powerplants.

We do not believe, however, that NRC has a firm basis for its current approach to PFE. In fact, NRC's planning

and decisionmaking process for selecting another ERDA laboratory at which to start another PFE type project is repeating some of the same mistakes that led to the cancellation of the original project. For example, the laboratories were asked to quickly prepare cost and schedule estimates on a very complex project. The apparent winning laboratory, in fact, had its cost estimate almost doubled by NRC because NRC considered it to be unrealistic. Moreover, selection of a laboratory and scale based on available steam capacity is not a sound justification.

The NRC/ERDA relationship which troubled LOFT and the cancelled PFE projects has still not been worked out. Our observations are that this relationship is not improving. Going forward with a new PFE project while this situation exists would be a mistake.

Part of NRC's complaint about the cancelled PFE contractor was that it never demonstrated the ability to design and construct large experimental facilities. However, the new PFE experiment, if built at the site proposed by Livermore as expected, would involve a contractor whose experience, according to NRC's own evaluation, may not match requirements of the project. NRC believes that a careful selection of an experienced architect-engineering firm will be necessary if the project is to be successful at Livermore.

Also, NRC is attempting to keep the testing period for the new PFE project under 3 years. This could permit operations appropriations to be used to construct the facility, even though it could cost $40 million or more.

Aside from management and project control considerations, we believe that it is uncertain whether NRC can obtain its stated benefits by proceeding with the currently proposed new 1/3- or 1/2-scale test facility. Information from such tests may be difficult to extrapolate to large scale reactors and might not be sufficient to justify a change in licensing requirements or to specifically define the degree of conservatism in current reactor designs. Larger scale tests --close to full scale--may be needed to gain the necessary confidence to eliminate the uncertainties in extrapolating test results to full scale reactors. There was some feeling among our consultants that the concept in the cancelled 1/5- and 4/5-scale project could be more useful than NRC's 1/3- or 1/2-scale proposal.

In summary, we are not convinced that the NRC approach to obtaining information on the bypass phenomenon is sound. Our consultants have raised many questions which indicate to us that NRC has not done all of the technical homework that

is necessary to obtain valid technical information. Therefore, coupled with the management mistakes that are occurring, we believe that NRC is heading towards another problem project.

RECOMMENDATIONS TO THE CHAIRMAN, NRC

The Chairman should

--postpone all decisions on the new Plenum Fill Experiment project until a conceptual design is completed which provides a realistic scope, schedule, and total estimated cost, and until an agreement is reached with the Energy Research and Development Administration for managing the project as well as future reactor safety projects,

--institute measures to minimize the use of operating appropriations for construction activities, and

--alert the Congress to any construction activities for which more than $1 million of operating appropriations is obligated.

RECOMMENDATIONS TO THE ADMINISTRATOR, ERDA

The Administrator should

--reach an agreement with the Nuclear Regulatory Commission for managing the new Plenum Fill Experiment as well as for future reactor safety projects,

--institute measures to minimize the use of operating appropriations for construction activities, and

--alert the Congress to any construction activities for which more than $1 million of operating appropriations is obligated.

RECOMMENDATIONS TO THE JOINT COMMITTEE ON ATOMIC ENERGY

The Joint Committee should

--require the Nuclear Regulatory Commission to prepare a conceptual design, fully justify and explain its approach for the new Plenum

Fill Experiment, and reach an agreement with the Energy Research and Development Administration for managing reactor safety research projects before authorizing any additional funds for a new PFE project, and

--require the Nuclear Regulatory Commission and the Energy Research and Development Administration to institute measures to minimize the use of operating appropriations for construction and to alert the Congress to any construction activities for which more than $1 million of operating appropriations is obligated.

AGENCY COMMENTS ON THE PRELIMINARY REPORT

On July 16, 1976, we sent copies of our preliminary report to NRC and ERDA for comment. During the week of July 26, 1976, we met with representatives of both agencies to discuss the report and subsequently received letters from them which stated their objections--primarily to our conclusions and recommendations.

NRC comments

NRC's main objection was to our conclusion that NRC was repeating some of the mistakes which led to the cancellation of the original project. In particular, NRC cited its current plans to complete a conceptual design study before it decides to go forward with the project.

We agree that NRC should complete a conceptual design in order to "provide the technical basis for the design of the facility and a firmer estimate of the facility cost." We must point out, however, that this was not the intent of the NRC staff until very recently. This recent change was brought about by occurrences, such as the congressional interest shown in the project, the reduction of funds authorized for the project in fiscal year 1977, and ERDA's objection to the use of its Livermore laboratory to manage the project.

Before these occurrences, NRC was planning to very quickly select a contractor to design, construct, and operate a new PFE type facility. This is evidenced by the fact that NRC

--solicited and received proposals from five ERDA laboratories,

--established a review committee which visited the five laboratories and which evaluated and rated the proposals based on certain evaluation criteria, and

--proposed the selection of the Livermore laboratory to ERDA for approval.

However, the House Appropriations Committee reduced the funding for the project, the Joint Committee on Atomic Energy staff requested briefings on the project's large cost growth, and ERDA objected to extensive use of its weapons laboratories for NRC-type projects. Also, ERDA notified NRC that it would not fund the project's construction costs because of NRC's lack of project definitions. This has caused NRC to re-evaluate the project and to develop what we believe is a more acceptable approach.

NRC also disagreed with our conclusion that the NRC and ERDA relationship is not improving. Instead, they note that both agencies are relatively new and while some difficulties exist, such as on PFE, most relationships are good and the agencies are working closely to improve those which are not. We have reviewed only two projects--PFE and LOFT--and are not familiar with the relationships on the other NRC/ERDA managed projects. However, LOFT and PFE are the two major safety facilities dedicated to NRC's mission to confirm the safety of current commercial powerplants. From the perspective that these two reviews have given us, we believe that the relationships are much less than desirable and are not improving. For instance, for any new PFE project, NRC and ERDA still have not agreed on

--which agency should fund the construction or operation of the facility,

--which agency has management responsibilities for the facility's construction, or

--what level of support the ERDA laboratories will provide NRC on this project.

In addition, a recently issued NRC internal audit report concluded that "* * * NRC/ERDA relations have had over a year to develop and, unless the concerns and problems expressed herein are confronted, precedents could be established which may be difficult to reverse." Specific concerns were the lack of clarity of each agency's responsibilities, the complexity of the agencies' working arrangements, and the lack of direct access of NRC to ERDA's laboratories. NRC's Executive Director for Operations

agreed with the internal audit report findings and indicated that he sent a letter to ERDA proposing the formation of a joint task force to look into the NRC/ERDA working arrangement for conducting NRC research projects.

Concerning the proposed scale for a new PFE facility, NRC acknowledged in its letter that the scale selected was judgmental but that the weight of expert opinion was that the one-third scale was the smallest size that could be used to verify current theories on the emergency core cooling bypass phenomena. We cannot definitely conclude that NRC's scale selection of one-third is without some foundation. However, enough doubt about the potential success of a 1/3-scale test was expressed by our consultants and others for us to conclude that NRC should reassess its position during the preliminary design phase for the new project.

ERDA comments

ERDA's primary concern was our recommendation to minimize the use of operating funds for construction activities and the implication that ERDA consciously concealed from the Congress the cost growth of the PFE project. They also had concerns over the statement that the project resulted in a waste of $5 million.

ERDA stated in its letter that it has been a long established policy that short-lived experiments (those with a useful life of less than 3 years) be funded from its operating expense appropriation. It also believes that its present policies adequately define procedures and include sufficient controls for the use of operating funds for construction activities. It cited a section in ERDA's procedures which requires these types of experimental projects to be subject to construction cost control procedures.

We do not disagree with ERDA's overall policy of funding short-lived projects with operating appropriations. In fact, we believe it is necessary for an agency to have some flexibility to accomplish its research and development mission. We find it unacceptable, however, that a project can increase to the proportions of PFE and not come under congressional scrutiny. When a minor experimental project involving construction activities grows into a major construction or research project, the Congress should be so informed and consideration should be given to identifying the project as a line item in the budget so that specific congressional authorization can be obtained. Whether the Congress was not informed on PFE because of oversight or some contrived action is not determinable. The point is that depending on voluntary disclosure did not work. Therefore, our recommendation

is designed to establish a formal reporting system for such projects to insure that the Congress is kept informed.

Another ERDA comment relates to our statement that the cancelled PFE project involves a waste of $5 million. ERDA notes that the project costs are about $7.4 million, of which about $2.5 million represents procured materials and the remaining $5 million represents amounts expended for design and construction activities. ERDA further notes that while these funds have not achieved the project objectives, some value can be placed on the research conducted to increase the state-of-the-art, and that the total $5 million should not be classified as waste. This assessment has some merit but we stress that no dollar value has been, or realistically can be, placed on the research conducted. In addition, it is not likely that all the $2.5 million of procured materials will be usable on any future project. As of yet, ERDA has not determined how much of the PFE equipment at Richland is reusable. Therefore, while some undetermined value can be placed on the research efforts, some or perhaps all of this value could be offset by the cost of procured but unusable PFE equipment.

In addition, ERDA had some other objections of an editorial nature.

CHAPTER 5

SCOPE OF REVIEW

We obtained the information used in this report by reviewing planning documents, reports, correspondence, and other records, and by interviewing officials at

--NRC Headquarters, Bethesda and Germantown, Maryland,

--ERDA Headquarters, Germantown, Maryland,

--ERDA Richland Operations Office, Richland, Washington, and

--Battelle, Pacific Northwest Laboratories, Richland, Washington.

We also employed four experts who addressed some technical questions relating to the importance and scale of the Plenum Fill Experiment. Officials from NRC and ERDA laboratories reviewed a preliminary copy of this report and disagreed with some parts as expressed in the letters in appendices III and IV. Battelle, Pacific Northwest Laboratories also reviewed and commented informally on part of the report which pertained to their performance.

REASONS FOR THE PFE COST ESTIMATE INCREASE--$14.7 MILLION IN 1974 TO $36 MILLION IN APRIL 1976

1. Rerouting PFE facility effluent, adding additional instruments and view ports for data collection, early testing of small vessel, and adding the capability to directly inject cooling water into the large vessel: IMPACT--increase of about $1,672,000 (February 1975).

2. Heating the PFE facility building, reanalyzing the facility design, and escalating construction and procurement costs: IMPACT--increase of about $921,000 (April 1975).

3. Designing and purchasing a replacement for the existing Government furnished large simulator vessel which was found defective and unusable, reestimating the costs for preliminary testing and operations, reanalyzing the facility design to incorporate the new large simulator vessel, and escalating construction and procurement costs: IMPACT--increase of about $6,871,000 (August 1975).

4. Increasing from 3 to 6 months the operating acceptance test period, refining the facility design, and reanalyzing test specifications, technical analysis activities, and facility test operations: IMPACT--increase of about $2,804,000 (September 1975).

5. Refining the contractor's cost estimate: IMPACT --increase of about $1,108,000 (October 1975).

6. Expanding the test program for 65 tests within 9 months to 103 tests over a 24-month period, lengthening the operational acceptance testing period, increasing project control and management costs, adding various safety features, and increasing design and procurement and construction costs: IMPACT--increase of about $9,000,000 (April 1976).

APPENDIX II

LIST OF CONSULTANTS AND THEIR ASSOCIATIONS

Dr. Joseph M. Hendrie, Brookhaven National Laboratory

Mr. Romano Salvatori, Westinghouse Electric Corporation

Mr. Carl J. Hocevar, Union of Concerned Scientists

Dr. Fred C. Finlayson, Aerospace Corporation

APPENDIX III

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

August 2, 1976

Mr. Monte Canfield, Jr.
Director
Energy and Minerals Division
United States General Accounting Office
Washington, D. C. 20548

Dear Mr. Canfield:

The Nuclear Regulatory Commission has reviewed the proposed draft GAO report entitled, "Poor Management of a Nuclear Light Water Reactor Safety Project." While the general thrust of the report's findings of past management deficiencies on PFE is correct, we believe that the report presents a number of premature conclusions relating to the present NRC research plans for the new ECC Bypass Test Facility (EBTF), the restriction in the use of operating funds, the choice of 1/3 scale or larger facility, and the working relationship between NRC and ERDA. It is suggested that these be eliminated from the final report.

We find little substantiation for the view that the Nuclear Regulatory Commission's planning and decision-making process for EBTF is in the act of repeating some of the same mistakes that led to cancellation of the original project. We feel that the conclusion does not reflect the following facts:

- o NRC plans for the start of the EBTF include the completion of a conceptual design study before it is decided to go forward with the experiment. We plan to proceed with the study since it is needed to provide the technical basis for the design of the facility and a firmer estimate of the facility cost.

- o We are also having discussions with ERDA about how our two agencies can best organize to design, construct and operate the facility. We do not intend to proceed with the experiment until the conceptual design is completed and a sound technical and management structure is established for the accomplishment of this experiment.

- o The presumption that the new ECC Bypass Test Facility is to be designed and managed by ERDA's Lawrence Livermore Laboratory (LLL) is incorrect. No decision has yet been made on the role of ERDA laboratories in designing and managing the construction and operation of a new facility.

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Mr. Monte Canfield, Jr.

In summary, the lessons learned from our experience with PFE are clear; we must have firm test and design requirements, sound cost and schedule estimates and a sound management structure in place before a final decision is made to proceed with construction of a new facility. NRC recognized the deficiencies in the PFE project, has taken decisive action to terminate PFE, and does not intend to permit the same mistakes to occur in the EBTF. We suggest that the draft report be revised accordingly.

Regarding the recommendation in the report to minimize the use of operating appropriations for construction, we agree that there must be adequate fiscal controls over the projects in our research programs. In fact, NRC has already taken steps to ensure implementation of its procedures to inform Congress of significant cost changes in our research projects. However, there have been several instances in the past both under the former AEC and NRC where smaller experimental facilities have been built with operating funds without significant problems occurring. We believe it is necessary to maintain the capability to build test facilities using operating funds in order that our research program can respond to our needs for information. For example, the NRC licensing staff identified in March 1976 an urgent need for confirmatory research data on the loads experienced by a BWR pressure suppression type containment during a loss-of-coolant accident. NRC was able to start a research program at Lawrence Livermore Laboratory within a few months after the problem was identified, and we expect to have the test facility completed and to obtain the first data by the end of 1976 or early 1977. In the case of large test facilities, such as EBTF, which are projected to cost over several million dollars, and for which ERDA would have the construction responsibility, we are in agreement that they would be funded more properly with construction appropriations. To assure that Congress is adequately informed, we plan to identify and highlight any significant construction efforts in justification material in support of budget requests and major reprogramming requests.

We do not agree with the conclusion that NRC does not have an adequate basis for establishing the scale of the EBTF facility. While the decision on the scale of this facility is judgemental and must consider many factors, there is nevertheless a sound basis for determining what the scaling should be in order to determine the desired data. Extensive technical discussions were held within NRC and with the technical experts on our PFE Review Group concerning the proper scale size for an ECC Bypass Test Facility. The weight of expert opinion is that a 1/3 scale facility represents the minimum size that could be used to verify theories developed on smaller (1/30 and 1/15) models,

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and of course, larger facilities would be even better. On the basis of these discussions and our desire to have a cost-effective program, NRC chose a 1/3 scale facility as a basis for investigating alternates to the PFE. No new factual information has come to light to suggest that a 1/3 scale facility would not be adequate, nor for that matter, that a 1/2 or larger scale facility would yield definitive conclusions. The scale of the EBTF facility will be selected depending on results of the design and cost analysis to be conducted as part of the conceptual design studies.

We do not agree that the quality of the NRC-ERDA handling of joint research projects is deteriorating. NRC has significant research programs in ERDA laboratories, and most of them are progressing in a satisfactory manner. Both NRC and ERDA are relatively new organizations and while there were difficulties in connection with some programs, such as PFE, we have been working closely with ERDA to improve our working relationships. In particular, we have been working closely to arrive at a mutually acceptable arrangement for proceeding with the conceptual design study for the EBTF. We believe that a satisfactory basis for going forward with this project can be achieved.

Enclosed is an annotated copy of the draft report which identifies those sections which we believe are incorrect. We appreciate the opportunity afforded NRC to comment on this draft report.

Sincerely,

Lee V. Gossick
Executive Director
for Operations

Enclosure:
Draft GAO Report

APPENDIX IV

UNITED STATES
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
WASHINGTON, D.C. 20545

August 4, 1976

Mr. Monte Canfield, Jr., Director
Energy and Minerals Division
U.S. General Accounting Office
Washington, DC 20545

Dear Mr. Canfield:

Thank you for the opportunity to comment on the draft report entitled "Poor Management of a Light Water Reactor Safety Project" which deals with the Plenum Fill Experiment (PFE).

We have reviewed the draft with members of your staff and we understand that a number of changes and clarifications which we suggested will be made. However, we have been asked to bring the following residual matters to your attention.

Starting with the judgmental title of the draft, we are concerned with the overall tone, implications and perspective of the report. Specific matters with which we are particularly concerned are:

1. The statement on page i of the Digest and elsewhere in the body of the report that "The cancelled project involves a waste of at least $5 million."

   The cancelled project has costs approaching $7.4M of which about $2.5M represents materials procured and delivered and some materials which have been procured but not delivered due to holds imposed on the project. The remainder of approximately $5M represents amounts expended for design and construction activities. While it is true that these funds will not have fully achieved the project objectives, nevertheless, we believe that the substantial experience gained in the solution of the complex stress analysis represents advances in state-of-the-art in dealing with steam water mixing phenomena and associated oscillatory flows, and establishment of forcing functions to be considered in analyzing the systems. No specific amount has been assigned to the value of those principles in their application to other programs, but we feel that it is inappropriate to categorize these efforts as a "waste."

2. The statement on page 22 that the use of operating funds "permitted the circumvention of."

   This statement implies that a specific conscious effort was made to cover-up or to conceal in a surreptious manner, the fact that

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operating appropriation funds were being utilized for the experiment. In accordance with long established AEC policies and procedures, well recognized and accepted by GAO, OMB, and the Congress, short-lived experiments (those with a useful life of less than 3 years) were to be funded from our operating expense appropriation rather than the plant and capital equipment appropriation. By its very title, "Plenum Fill Experiment," and particularly because of its relatively small initial scope, the experiment was funded from the operating appropriation.

3. The recommendation in the Digest and in the body of the report that ERDA institute measures to minimize the use of operating appropriations for construction activities.

   We believe that ERDA's present policies adequately define procedures for use of construction versus operating funds, and for appropriate controls over construction type activities in the operating account. Your attention is invited to ERDA Appendix 1101, Part VI, 4.f. and g. wherein procedures are established to define experimental projects and require such projects to be subject to construction cost control principles.

In addition to the major concerns referred to above, we have considerable difficulty with some of the alarmist and misleading type language used in the report. Examples are the statement on page 1 that uncontrolled release of radioactivity into the atmosphere could "destroy" many lives and property, statements in several places in the report alleging a poor relationship with NRC and "confusion" regarding management of the project. Regarding the release of radioactivity, we would agree that it could "endanger" lives and property, but it would not automatically "destroy." As indicated in a letter as recent as July 1, 1976, from Lee V. Gossick (NRC) to the Honorable Joe L. Evins, NRC has "continued to work closely" with ERDA.

It is requested that the concerns expressed in this letter be appropriately reflected both in the Digest and body of the report.

Sincerely,

E. H. Schneider

M. C. Greer
for Controller

APPENDIX V

PRINCIPAL OFFICIALS RESPONSIBLE FOR ADMINISTERING ACTIVITIES DISCUSSED IN THIS REPORT

	Tenure of office	
	From	To
ATOMIC ENERGY COMMISSION		
CHAIRMAN:		
Dixy Lee Ray	Feb. 1973	Jan. 1975
James R. Schlesinger	Aug. 1971	Feb. 1973
Glenn T. Seaborg	Mar. 1961	Aug. 1971
GENERAL MANAGER:		
Robert O. Thorne (Acting)	Jan. 1975	Jan. 1975
John A. Erlewine	Jan. 1974	Dec. 1974
Robert E. Hollingsworth	Aug. 1964	Jan. 1974
DIRECTOR OF REGULATION:		
L. Manning Muntzing	Oct. 1971	Jan. 1975
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION		
ADMINISTRATOR:		
Robert C. Seamans, Jr.	Jan. 1975	Present
NUCLEAR REGULATORY COMMISSION		
CHAIRMAN:		
Marcus A. Rowden	Apr. 1976	Present
William A. Anders	Jan. 1975	Apr. 1976