United States General Accounting Office

GAO Testimony

For Release
on Delivery
Expected at
9:30 a.m. EST
Thursday
March 12, 1987

Management and Safety Issues Concerning DOE's Production Reactors at Savannah River, S.C.

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Before the
Committee on Governmental Affairs
United States Senate

GAO/T-RCED-5

Mr. Chairman and members of the Committee:

We appreciate the opportunity to discuss our ongoing work for this Committee concerning various aspects of the Department of Energy's (DOE) production reactors at the Savannah River Plant in South Carolina. Our work is not yet complete; therefore, the information we will be discussing today is subject to change. We will continue our audit work for the next couple of months and plan to issue a report to the Committee this summer. While our audit work is still underway, some of the issues we have identified to date are potentially very serious. When these issues are taken together, the overall message they convey is a need for better management of the Savannah River Plant reactor operations.

At your request, our testimony today focuses on three specific issues we are reviewing at Savannah River: first, the testing techniques currently being used to determine potential cracks in one or more of the reactor tank walls; second, a recent reduction in the operating power of the plant's reactors for safety reasons; and third, a lack of management attention in promptly addressing identified problems with reactor operations and maintenance activities.

We would like to call your attention to the effect that two of these issues could have on DOE's ability to produce weapons-grade material for national defense. The R-reactor has not operated since 1964. The C-reactor is shut down because of cracks in the reactor tank wall. The production capacity of the remaining three operating reactors, L, K, and P, has been reduced because of the recent 26 percent power reduction. In addition, the L-reactor's production capacity is further reduced because it does not operate in the summer months. This situation at Savannah River, coupled with uncertainties about the future operation of the N-reactor in Washington State, raises questions about DOE's ability to meet production requirements.

Before discussing the details of our review, I would like to provide a brief overview of the Savannah River Plant and an overall status of the production reactors.

SAVANNAH RIVER PLANT OVERVIEW

The Savannah River Plant primarily produces plutonium, tritium, and other special nuclear materials for national defense purposes. DuPont constructed the plant in the early 1950's and has operated it for DOE under a cost reimbursement, no-fee type contract. Savannah River's major facilities include five nuclear production reactors, a plant for fabricating fuel and target elements to be used in the reactors, two chemical separations plants for processing these elements, a research and development laboratory, and various support facilities.

Two of the five nuclear production reactors at Savannah River are shut down. The R-reactor has not operated since 1964 and DOE considers it in standby status. The C-reactor has not operated since July 1985. At this time DOE does not know when, or if, it ever will be restarted. After 17 years on standby, the L-reactor was restarted in October 1985. It is not operating at full production capacity because operation during the summer months would raise the temperature of the reactor's discharge pond above state environmental standards. Further, DuPont recently reduced the operating power of the three operating reactors--L, K, and P--by about 26 percent.

I would now like to discuss specific concerns that we have identified in our ongoing work.

TESTING FOR CRACKS IN THE REACTORS

Stress corrosion cracks (cracks) have been identified in the C-reactor's stainless steel tank wall. A crack in the tank wall is of particular concern because, if it goes through the wall, radioactive water would leak from the tank and release radiation into the atmosphere. In a worst case situation, a large crack could eventually split the tank in half. Because the cracks in the C-reactor tank wall could not be repaired, it has been shut down since July 1985. Unless repair techniques can be developed, it may never operate again. Although DuPont has inspected the other reactor tanks, we are concerned that it has not used "state-of-the-art" inspection methods both to identify cracks and to determine if there is a safety or operational concern that needs immediate attention or that might cause a problem in the future.

DuPont's inspection method for the reactor tanks relies heavily on visual inspections with a periscope. This method has limitations because there is no assurance that all the weld areas have been identified because an oxide buildup on the tank walls may obscure identification of the welds. Also, many of the inspection reports cite problems with certain equipment used during the inspections.

DuPont's visual inspections have found marks on the K- and L-reactor tank walls. DuPont decided that it would use a penetrating dye to test marks which met preestablished crack criteria. The marks on the K-reactor tank wall were not dye-tested because they were smaller than the established criteria. Last fall, during a maintenance shutdown of the L-reactor, marks were identified that might have been cracks. Therefore, based on the criteria, about half of the marks identified were dye-tested to determine if they actually were cracks. No cracks were found and the L-reactor was restarted in December 1986. While DuPont believes the marks are surface corrosion, it is still analyzing scrapings from the marks to determine if this is the case. Although the dye test used for the L-reactor can identify cracks better than visual inspection, it is limited because it cannot determine a crack's depth--in other words, how close it is to breaking through the wall.

The commercial nuclear industry uses methods that differ substantially from those used by DuPont at Savannah River. The commercial industry uses ultrasonics to inspect reactor vessels. While no inspection method is exact, an ultrasonic inspection program will locate the weld areas and can determine with better accuracy than a periscope a crack's length. In addition, unlike the visual or dye tests, it can determine the depth of a crack. Because it is superior to other methods, Nuclear Regulatory

Commission officials told us that ultrasonic testing has become the accepted practice for the nuclear industry.

Although ultrasonic testing is not part of its regular inspection program, DuPont has used it to characterize the length and depth of the C-reactor cracks. According to a DuPont official, those tests showed that the cracks were longer and deeper than originally thought and also identified cracks that had not been seen visually. In addition, the Los Alamos National Laboratory, which reviewed the C-reactor repair effort at DOE's request, recommended that ultrasonic testing be used to test the effectiveness of the repair because of limitations they identified in the visual and dye tests.

Finally, the visual inspection reports for the L- and K-reactors recommend ultrasonic testing of their tanks to ensure continued safe operation of the reactors. However, DuPont does not plan to begin ultrasonic testing until 1988 and then will only inspect a portion of the tank during each reactor's normally scheduled maintenance shutdown so that production will not be affected. A full inspection could take a number of years, depending on how much is done each time.

We believe that moving to ultrasonics is an important step in enhancing the level of safety for the reactors at Savannah River. The use of ultrasonics will better identify whether cracks exist. In addition, it characterizes their length and depth so that DuPont could determine when they might become a safety or operational problem. Therefore, if cracks do exist, finding and characterizing them is critical to both assessing near-term safe operation and determining the reactors' life expectancy.

REDUCTION IN OPERATING POWER TO ENSURE SAFETY

The power level at which the Savannah River reactors operate safely is based on a number of different factors; one of them is the effective operation of the emergency cooling system. That system is designed to prevent reactor fuel melting which could potentially release large quantities of radioactive elements into the atmosphere. The emergency system would be activated in the event of an accident in which the primary system to cool the reactor core is cut off either by a pipe break or pump failure.

Since 1980 the operating reactors at Savannah River have operated at or near their maximum power levels. However, in November 1986 DuPont reduced the operating power levels of the reactors by about 20 percent; they were cut an additional 6 percent in December. These reductions were made necessary by information developed by DuPont's Savannah River Laboratory during its review of the emergency cooling system power limits developed in 1979. The laboratory's work, which reviewed the power limits established in 1979, raised questions about whether the emergency cooling system was capable of preventing fuel melting during an accident when the reactor was operating at maximum power.

The laboratory's preliminary report, issued on December 1, 1986, states that the model used to calculate the power limits has a number of limitations. For example, the reactor assembly apparatus used in the experiments did not resemble the typical Savannah River reactor assembly. Therefore, the 1979 experiments may not have provided correct information on the amount of cooling water needed to prevent fuel from melting or steam building up in the event of an accident at the reactor.

The laboratory is continuing its studies and experiments to establish the emergency cooling system power limits. It believes that the recent reductions bring the operating power to a conservative level until the final limits are established, scheduled now for sometime this fall. While the laboratory is studying the limits, DuPont is assessing a number of options to compensate for the problems raised by the 1979 experiments so that higher power levels can be resumed. One idea under consideration is adding an additional emergency cooling system to increase the amounts of cooling water flowing through the reactor assemblies.

The circumstances we have just described illustrate that the reactors had operated for about 6 years at a higher power level than may have been safe for the emergency cooling system in the event of an accident.

We understand that the National Academy of Sciences has recently become aware of this situation and is reviewing it as part of their review of the Savannah River reactors. The Academy's work at Savannah River is part of an overall review of DOE's reactors that DOE requested after the Chernobyl accident.

MANAGEMENT OF REACTOR OPERATIONS AND MAINTENANCE ACTIVITIES

We have identified other concerns that could further affect the safe operation and maintenance of the Savannah River reactors. Specifically, there does not appear to be an effective management system to ensure timely clearance of action items related to reactor operations. We are also concerned about the many problems raised in DuPont and DOE reports about the maintenance program at the complex.

Backlog of action items related to reactor operations

In 1985 DuPont established the Reactor Safety Evaluation Division to provide safety oversight. We have reviewed several of this division's reports. They generally conclude that no effective management system exists to ensure timely clearance of action items related to reactor operations. For example, a June 1986 report discusses the backlog of recommended actions stemming from the reactor incident report system. That system reports anything out of the ordinary related to reactor operations, attempts to identify its cause, and makes recommendations to correct the problem.

The report points out that the backlog is large and growing. As of the end of 1985, 198 reactor incident report recommendations, some dating back to the late 1970's, were still outstanding. This represents a 13 percent increase from the prior year. Further, the number of safety-related recommendations grew from 34 to 48 during the prior year. This represents an increase of 41 percent.

The Division's report explained the backlog's significance by comparing the situation to what led to the Three Mile Island accident. The report stated that:

> "A large backlog could contain, and conceal, a combination of faults that could lead to a serious event. The best way to minimize this possibility is to reduce the backlog to eliminate contributors or to make dangerous combinations more discernible."

We are concerned that this backlog has potential safety implications.

In addition, about 25 percent of new reactor incidents that occurred in the first 6 months of 1986 were caused by open items that had not been acted on or for which the action taken was not effective. Finally, in a November 1986 letter, the Reactor Safety Advisory Committee, a group of DuPont executives and consultants who comment on various reactor safety issues, stated their concern about the backlog of reactor incident report recommendations. They believe that the backlog may indicate a trend toward a gradual deterioration of safety at the Savannah River reactors.

To determine the extent of the backlog, the Reactor Safety Evaluation Division looked at other actions that could affect reactor operations. Its December 1986 report on this subject, which built upon information developed in their June report, identified over 1,000 items requiring action. These items, some dating back as far as 1978, include recommendations that improve safety or productivity.

Some comments made in this report include the following:

-- Priorities are not documented for these open items and in most cases do not exist.

-- Items related to reactor safety are not identified or highlighted as such.

-- It is not apparent from current tracking methods if items are being actively worked on, who has responsibility, and when resolution is due.

-- It is not possible to judge the effect that the backlog will have on staff resources, costs, and amount of time needed to reduce the backlog.

DuPont has a number of initiatives underway or proposed that it believes will reduce the backlogs and provide for better management of these action items in the future. They include designing and implementing several computerized tracking systems, reducing the number of open action items by having employees work overtime for 2 months, and studying an overall management system to ensure timely actions. To the extent possible, we will evaluate these actions in our report.

<u>Maintenance program upgrades</u>

Over the past few years both DOE and DuPont reports and safety appraisals have raised concerns about numerous aspects of the reactor maintenance program. Some examples of comments made in these reports are as follows:

-- The maintenance work control system does not provide management with adequate information on (1) reactor system repair work that needs to be done and the relative significance, including safety implications of that work, and (2) the status of preventive maintenance.

-- Some maintenance activities are being conducted with little or no procedural guidance.

-- Improve and expedite the formal on-the-job training program to ensure that mechanics acquire the necessary job skills and knowledge during their 4-year training period.

In addition, our work has shown that classroom training is not provided on the specific reactor systems and equipment on which the mechanics work or on the safety importance of the equipment as required for commercial reactor maintenance personnel.

It is important to understand these comments in the context of the current reactor maintenance workforce at Savannah River. The maintenance mechanics who built and then maintained the reactors have retired. As a result, 40 percent of the maintenance workforce now are trainees. Therefore, we are concerned that inexperienced personnel are maintaining the reactors without adequate training and, in some cases, without proper written procedures. In addition, management's current monitoring system does not adequately provide information to determine the timeliness of reactor maintenance, such as when reactor repairs need to be done and the status of preventive maintenance.

DuPont also has programs planned or underway to address these concerns. Two of these programs include a system to better monitor the maintenance work and a project to write or revise over 1,000 maintenance procedures. Until these procedures are prepared and a provision for appropriate supervisory review is added, the rather inexperienced maintenance personnel will have inadequate written direction to perform some maintenance activities. In addition, DuPont is upgrading its classroom training program that it plans to implement over the next 7 years, and is pilot-testing a formal on-the-job training program.

We are concerned that management inattention contributed to the operations and maintenance problems we have described. For example, a February 1981 DOE task force report reviewed the lessons DOE could learn from the Three Mile Island accident. It recommended that Savannah River improve the content and quality of the maintenance procedures and training because its experienced maintenance people would soon be eligible for retirement. Those issues are just now being addressed. If operations at Savannah River are to improve, we believe they now must become a high priority. We are concerned that this is not the case. For example, according to a DuPont official, it will take 2 or more years to write the maintenance procedures. Furthermore, we understand that the classroom training program is already behind schedule because funds are not available to complete the maintenance task analysis, which is the basis of the second phase of the training.

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That completes my prepared statement. We will be glad to respond to any questions at this time.