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UNITED STATES GENERAL ACCOUNTING OFFICE  
WASHINGTON, D.C. 20548

ENERGY AND MINERALS  
DIVISION

May 14, 1982

B-207484

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RELEASED

The Honorable Richard L. Ottinger  
Chairman, Subcommittee on Energy  
Conservation and Power  
Committee on Energy and Commerce  
House of Representatives



118426

Dear Mr. Chairman:

Subject: DOE Confident It Can Fuel the Clinch River  
Breeder Reactor and Other Breeder Reactor  
Projects (GAO/EMD-82-89)

In a March 19, 1982, letter, you requested that we review certain aspects of the plutonium fuel supply for the Clinch River Breeder Reactor (CRBR) as well as for other projects within the Department of Energy's (DOE's) breeder reactor program. You expressed concern that the plutonium necessary for the Nation's defense programs might limit the availability of plutonium for the breeder reactor projects. On April 22, 1982, we briefed your staff on our work and informed them that we could not verify that adequate plutonium would be available for the breeder reactor projects. Such verification would require that we examine classified information and your office wanted an unclassified report. In lieu of a classified report, your office requested that we provide you a written report on

- the plutonium requirements for the CRBR and other breeder reactor projects,
- the source of plutonium for meeting these requirements, and
- DOE's proposed modification to an existing DOE fuel reprocessing facility to expand its capability for supplying plutonium.

In summary, DOE is confident it can provide the plutonium needed to fuel the breeder reactor projects. DOE currently estimates an average of about 1,000 kilograms of plutonium would be required per year for the CRBR for a 10-year period beginning in fiscal year 1987 when the initial plutonium supply will be needed.

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It also estimates for the same 10-year period that an average of about 2,000 kilograms of plutonium would be required per year for its other existing and planned breeder reactor projects. DOE plans to meet these plutonium requirements from a combination of existing DOE inventories, reprocessed commercial reactor spent fuel, <sup>1/</sup> and other sources such as purchases from foreign countries, if needed. Finally, DOE has requested \$5.6 million for conceptual design efforts for the possible modification to an existing DOE fuel reprocessing facility which, if implemented, is expected to expand DOE's capability for supplying plutonium.

The following sections describe our objective, scope, and methodology, briefly describe the CRBR and DOE's breeder reactor program, and provide detailed information on the three topics listed above.

#### OBJECTIVE, SCOPE, AND METHODOLOGY

Our overall objective was to obtain information on the plutonium requirements for the CRBR and other breeder reactor projects, the source of plutonium for meeting these requirements, and DOE's proposed modification to expand its capability for supplying plutonium. We discussed the plutonium requirements with DOE headquarters officials responsible for managing the breeder reactor program and officials at Oak Ridge, Tennessee, responsible for managing the CRBR project. We also obtained and reviewed data on the plutonium requirements provided by these officials. In addition, we discussed the source of plutonium for meeting these requirements and DOE's proposed modification with officials of DOE's Office of Nuclear Materials Production who are responsible for supplying nuclear materials, such as plutonium, for all DOE programs. Furthermore, we reviewed documents relating to the proposed modification provided by officials at DOE's Richland, Washington, and Savannah River, South Carolina, Operations Offices and discussed the contents of these documents with appropriate DOE officials.

We performed our work in accordance with GAO's "Standards for Audit of Governmental Organizations, Programs, Activities, and Functions."

#### BACKGROUND ON THE CRBR AND DOE'S BREEDER REACTOR PROGRAM

From the nuclear power program's beginning, the Federal Government and the nuclear industry recognized that uranium resources are limited and long-term use of nuclear power would

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<sup>1/</sup>This spent fuel is used fuel from commercial nuclear reactors that can be recycled to extract plutonium produced during the nuclear fission process.

require more efficient use of domestic uranium resources. A breeder reactor, which produces more useable nuclear fuel than it consumes, would extend domestic uranium resources almost indefinitely. Thus, since the mid-1940s, various breeder reactor projects have been undertaken. In 1967, after evaluating several types of breeder reactors, the Atomic Energy Commission (AEC) 1/ declared the Liquid Metal Fast Breeder Reactor (LMFBR) to be its highest breeder reactor development priority and developed a broad-based LMFBR research and development program.

Since the LMFBR concept was selected for the breeder reactor program, several LMFBRs have been built. The most recent one--the Fast Flux Test Facility--was built for testing fuel, materials, and components. This facility, which began operating in 1980, cannot generate electricity, however, and was not intended to demonstrate the breeding of fuel. To provide such a demonstration, AEC planned several LMFBR demonstration projects, the first being a 375 megawatt 2/ plant--the CRBR. In 1970, the Congress authorized AEC to enter into cooperative arrangements with industry to build and operate the CRBR to demonstrate that an LMFBR could be licensed and operated reliably and safely on a utility electric power supply system. In January 1972, AEC entered into an agreement with the Tennessee Valley Authority, Commonwealth Edison Company, and Project Management Corporation 3/ to build the CRBR and operate it for 5 years. The CRBR is currently planned to begin operation sometime in 1989. In addition to the CRBR, DOE is planning the construction and operation of a large demonstration plant by 1995.

The fuel needed for the CRBR and other breeder reactor projects is made from plutonium. Plutonium is also used to make nuclear weapons. Since the beginning of the nuclear weapons program in the 1940s, plutonium has been produced at various Government-owned and operated facilities for national defense needs as well as for reactor research and development program needs. Plutonium can also be recovered through reprocessing spent fuel from commercial reactors and breeder reactors. However, presently these types of spent fuel are not being reprocessed because no reprocessing facilities for them are in operation.

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1/The AEC was a predecessor of DOE.

2/A megawatt is equal to one million watts.

3/The Project Management Corporation was formed as a non-profit organization by the utility industry to participate in the management of the CRBR.

PLUTONIUM REQUIREMENTS FOR THE CRBR  
AND OTHER BREEDER REACTOR PROJECTS

DOE projects that significant amounts of plutonium will not be needed until 1987 to meet the fuel requirements of its breeder reactor projects. These projects will include the Fast Flux Test Facility, the planned CRBR, and the planned large demonstration plant. The following table shows DOE's current estimated plutonium requirements for these projects for a 10-year period beginning in 1987.

BREEDER REACTOR PROGRAM  
PLUTONIUM REQUIREMENTS (note a)

<u>Fiscal year required</u>	<u>Fast Flux Test Facility</u>	<u>CRBR</u>	<u>Large Demon- stration Plant</u>	<u>Total</u>
	(in kilograms)			
1987	227	621	-	848
1988	-	1,801	-	1,801
1989	1,666	-	-	1,666
1990	-	2,359	-	2,359
1991	1,362	559	560	2,481
1992	-	1,552	2,600	4,152
1993	1,666	186	2,600	4,452
1994	-	2,173	2,600	4,773
1995	1,514	-	2,785	4,299
1996	-	1,045	2,785	3,830
<b>Total</b> (note b)	<u>6,435</u>	<u>10,296</u>	<u>13,930</u>	<u>30,661</u>

a/This is plutonium needed for fuel fabrication. Fluctuations in the plutonium quantities from year to year reflect the schedule for when the plutonium fuel can be fabricated.

b/Requirements beyond the 10-year period remain at 1,045 kilograms per year for the CRBR and 2,785 kilograms per year for the planned large demonstration plant. The Fast Flux Test Facility will require a total of 2,423 kilograms beyond fiscal year 1996 to around fiscal year 2000 when the facility is expected to terminate.

As the table indicates, for the 10-year period, DOE estimates that an average of about 1,000 kilograms of plutonium will be needed per year for the CRBR and about 2,000 kilograms of plutonium will be needed per year for the other breeder reactor projects. It should be noted, however, that the large demonstration plant has not been authorized by the Congress and if it is not built, the estimated total plutonium required per year for the breeder reactor projects would be significantly less.

SOURCE OF PLUTONIUM FOR MEETING THE  
FUEL REQUIREMENTS OF THE BREEDER  
REACTOR PROJECTS

DOE is responsible for providing plutonium for national defense and DOE civilian program needs, including the needs for DOE's breeder reactor projects. DOE's Office of Nuclear Materials Production (ONMP) which is under the Assistant Secretary for Defense Programs is responsible for meeting these needs. ONMP has traditionally provided and plans to continue providing plutonium to the breeder reactor program at no cost to the breeder program. The cost for providing plutonium is included in the budget for DOE's defense programs.

ONMP plans to provide the plutonium needed for the breeder reactor projects from a combination of existing DOE inventories, reprocessed commercial reactor spent fuel, and, if needed, other sources such as purchases from foreign countries. ONMP officials, however, would not specify the exact source of plutonium for the CRBR and other breeder reactor project needs because any such discussions may reveal classified information concerning the amount of plutonium to be used for national defense needs. In this regard, ONMP officials noted that plutonium needed for national defense takes precedence over all other needs. Thus, the amount of plutonium available for the CRBR and other breeder reactor projects could vary depending on the national defense needs.

Although ONMP officials would not be specific regarding the source of plutonium for DOE's breeder reactor projects, they assured us that the plutonium will be provided for such activities. They noted that in addition to existing inventories, they have several options. For example, as discussed more fully in the following section, they are currently exploring the possibility of modifying an existing DOE fuel reprocessing facility to enable it to reprocess commercial reactor spent fuel and other spent fuel such as breeder reactor spent fuel. This proposed modification, if implemented, would increase DOE's capability for supplying plutonium. ONMP officials stated that they could also purchase plutonium from foreign sources if needed. Furthermore, they noted that as the CRBR begins operating, it will generate approximately 25 percent more plutonium than it uses, thus, providing part of its own source of plutonium.

PROPOSED MODIFICATION TO  
AN EXISTING DOE FUEL  
REPROCESSING FACILITY

DOE's fiscal year 1983 budget request included \$5.6 million for conceptual design efforts for modifying one of its reprocessing facilities to expand DOE's capability for supplying plutonium. DOE currently operates two fuel reprocessing facilities

at Savannah River, South Carolina, and is preparing to restart a third fuel reprocessing facility at Richland, Washington, in 1984. DOE's existing reprocessing facilities produce plutonium for the defense programs by chemically dissolving the spent fuel components from DOE's plutonium production reactors and separating and recovering the plutonium and other elements from the spent fuel. DOE's existing reprocessing facilities cannot recover plutonium from commercial reactor spent fuel, spent fuel from the Fast Flux Test Facility, or the future demonstration reactor--the CRER. DOE does not have this capability because the fuel rods from these facilities are too long to fit into the existing system. In addition, these rods are generally made of material which cannot be easily dissolved with the chemical processes presently used by DOE.

The proposed modification would enable DOE to reprocess spent fuel from commercial reactors, the Fast Flux Test Facility, and the CRER. A "front end" unit would be added to an existing reprocessing facility which would chop the spent fuel rods into lengths suitable for the existing system and leach the plutonium and other elements from the rods. DOE's preliminary estimates indicate that the "front-end" unit could be operational by fiscal year 1989 if the project is authorized by the Congress. These preliminary estimates also indicate that an existing reprocessing facility with the proposed modification could be capable of (1) storing about 200,000 to 500,000 kilograms of commercial or breeder reactor spent fuel, (2) reprocessing the spent fuel at a nominal rate of about 420,000 kilograms of heavy metal 1/ per year, and (3) producing 3,780 kilograms of plutonium per year. The estimated cost of building the "front-end" unit ranges from \$300 to \$600 million and annual operation and maintenance costs are estimated to be about \$21 million. DOE officials noted that the estimated figures are very preliminary, and cautioned that later cost estimates could differ significantly as more precise information is known.

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As your office requested, to provide this report in time for the authorization hearings, we did not obtain formal comments from DOE. However, the information presented in this report was discussed with responsible DOE officials to ensure accuracy.

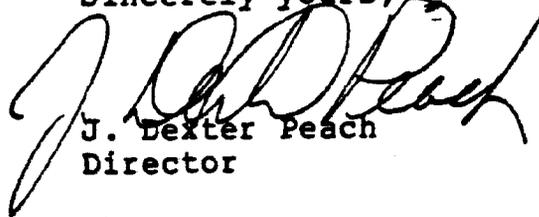
As also arranged with your office, we plan no further distribution of this report until 3 days from the date of the report.

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1/Heavy metal is the plutonium, uranium, and other elements contained in the spent fuel.

At that time, we will send copies of the report to the Director, Office of Management and Budget; the Secretary of Energy; and to other interested parties, and make copies available to others upon request.

Sincerely yours,

A handwritten signature in black ink, appearing to read "J. Dexter Peach". The signature is written in a cursive style with a large initial "J" and a long, sweeping underline that extends to the right.

J. Dexter Peach  
Director