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BY THE COMPTROLLER GENERAL



# Report To The Congress

OF THE UNITED STATES

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## The Clinch River Breeder Reactor--Should The Congress Continue To Fund It?

For the past 2 years, the Congress and the administration have been in a stalemate over the Clinch River Breeder Reactor Project. The Congress is appropriating funds to continue the project but the administration wants to terminate it.

This report's purpose is to help congressional decisionmakers focus on whether the Clinch River Breeder Reactor should be built. The weight of evidence gathered by GAO supports continuation of the Clinch River Breeder Reactor Project if this Nation wishes to maintain a strong breeder reactor research and development program. GAO notes that the administration is on record in support of a strong breeder reactor research and development program.



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COMPTROLLER GENERAL OF THE UNITED STATES  
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To The President of the Senate and the  
Speaker of the House of Representatives

This report is our latest study of the Department of Energy's liquid metal fast breeder reactor program. It was done as part of our continuing reassessment of critical national issues. Specifically, the report focuses on the debate that now surrounds the desirability of constructing a breeder reactor demonstration facility known as the Clinch River Breeder Reactor in Clinch River, Tennessee.

The objective of this report is to provide the Congress with a framework for deciding whether to terminate the Clinch River Breeder Reactor, as the administration has requested, or to construct it as now planned. Hopefully, our analysis of this issue will provide congressional decisionmakers with a sound framework for making this decision.

This report provides an analysis of what we believe are the key issues surrounding a decision to terminate or continue this demonstration plant. It also contains our position on what we believe is the best course of action to follow on this issue.

We are sending copies of this report to the Director, Office of Management and Budget and the Secretary of Energy.

A handwritten signature in cursive script, reading "Luther A. Starks".

Comptroller General  
of the United States

D I G E S T

Today, 70 commercially owned nuclear powerplants provide about 13 percent of the Nation's electricity. Another 102 plants are under construction or planned. All of these plants use uranium as fuel. However, it was recognized early in the Nation's nuclear power development program that uranium resources were limited and that a more efficient nuclear technology would have to be developed to make nuclear power a long-term energy supply option. After years of study and development, the liquid metal fast breeder reactor was chosen. This reactor can create more nuclear fuel than it uses and thus could extend nuclear fuel supplies indefinitely. (See p. 1.)

A major step in the U.S. breeder program was to build an intermediate-sized plant near Oak Ridge, Tennessee, called the Clinch River Breeder Reactor Project. The plant was to demonstrate that a liquid metal fast breeder reactor could be licensed and operated safely and reliably on a utility power supply system. The intermediate-size of the plant--about one-third commercial-size--was selected as a prudent step toward eventual full commercial-size powerplants.

In 1970, when it was originally conceived, the plant was expected to cost \$700 million. However, since that time, technical, environmental, and economic issues surfaced which caused project schedules to slip and costs to escalate. It is now estimated that the facility will cost about \$2.6 billion and will not be operational until 1987. (See pp. 3 and 18.)

In April 1977 the President proposed a major redirection in U.S. nuclear energy policies which included delaying liquid

metal fast breeder reactor development and terminating the Clinch River project. This redirected policy was based on (1) the President's concern that worldwide use of plutonium-based nuclear fuels--the fuel used by liquid metal fast breeder reactors--would lead to the proliferation of nuclear weapons and (2) projections that commercial breeder reactors were not needed as soon as was previously thought.

For the past 2 years, the Congress and the administration have been in a stalemate over whether to terminate the Clinch River project. In fact, the project has become the focal point of the controversy over the long-term use of nuclear power in this country. The administration often has stated its commitment to a strong liquid metal fast breeder reactor program but, at the same time, wants to terminate the Clinch River project. On the other hand, the Government has continued spending an average of about \$15 million per month to keep the project "marching in place." Under this status, no construction activities are underway and the time is rapidly approaching when the appropriated funds will be wasted. (See p. 4.)

In the past, GAO reports have recommended that the Clinch River project be continued as a logical step in the liquid metal fast breeder reactor program. Over the past 5 years or so, GAO has reported to the Congress on various aspects of the Clinch River project and the liquid metal fast breeder reactor program. The conclusions of these reports can be summarized as follows.

- There are many uncertainties regarding whether and when liquid metal fast breeder reactor commercialization is needed.
- The program is still in a research and development stage and the Clinch River project is the next logical step in providing the information needed to make a decision on possible consideration in the years ahead. Building the project does

not represent a decision to commercialize the technology.

This current report resulted from GAO's belief that a reexamination of the issues would be useful, especially in view of the administration's new proposal to terminate the Clinch River project and to replace it with a conceptual design effort for a much larger plant.

This report deals with the following issue: "In light of the administration's and Congress' intention to continue a strong liquid metal fast breeder reactor research program, is the administration's proposal justified and reasonable?"

Since April 1977 the President and administration spokesmen have supported their position that the Clinch River project should be terminated on the basis of

- nuclear proliferation concerns,
- a diminished need for commercial liquid metal fast breeder reactor facilities, and
- the Clinch River project's technical obsolescence, small size, and large costs.

GAO analyzed these justifications and other factors important to the question of whether the Clinch River project should be terminated or completed. The following overall observations flow from GAO's analysis.

- Terminating the Clinch River project accomplishes very little in the area of nuclear nonproliferation. (See pp. 7 to 9.)
- Because of the uncertainties inherent in forecasting electricity demand rates, uranium resources, and breeder economics, it is difficult to predict when commercial liquid metal fast breeder reactors will be needed. (See pp. 9 to 13.)
- The Clinch River project is not technically obsolete and its intermediate size is a

logical and prudent step in developing liquid metal fast breeder reactor technology. (See pp. 13 to 14.)

--If the Clinch River project is terminated, much of the \$674 million already spent on it may be wasted. (See pp. 18 and 19.)

--While skipping the Clinch River project for a larger plant does not raise any significant safety issues, the potential economic consequences and reduced public confidence in the safety of the larger plant could inhibit future efforts to commercialize the technology. (See pp. 14 to 16.)

--If the Clinch River project is terminated, utilities may end active participation in breeder reactor development, and nuclear suppliers' component design and fabrication capabilities may decrease significantly. (See pp. 16 to 18.)

--It will cost the Federal Government about \$1.292 to \$1.491 billion more to build the Clinch River project than to terminate it. (See pp. 18 and 19.)

The information gathered by GAO indicates that it will be difficult at best and perhaps impossible to maintain a strong liquid metal fast breeder reactor program without building the Clinch River project. In GAO's view, a reasonable program for breeder development, based on the progressive scaleup and demonstration of the safety and economic viability of the breeder reactor and supporting fuel cycle technologies, has been established. Continuing this program, in GAO's opinion, does not irrevocably commit the United States to wide-scale deployment of commercial breeder reactors nor does it mean that the United States cannot be committed to its nonproliferation initiatives. It does, however, permit the orderly development of a major energy technology through a demonstration phase that would make a commercialization decision possible.)

The recent accident at the Three Mile Island nuclear powerplant at Middletown, Pennsylvania, underscores the need for prudent and deliberate progress in developing nuclear fission or any other potentially dangerous technology. Licensing, constructing, and operating an intermediate size breeder reactor now is an appropriate step in perhaps demonstrating at some future time to utilities; the nuclear supply industry; and most importantly, to the public; that breeder reactors can be operated safely, reliably, and competitively with other energy technologies.

Both the administration and the Congress are on record as supporting a strong liquid metal fast breeder reactor program. The weight of evidence gathered by GAO supports continuation of the Clinch River project if this Nation is to maintain a strong breeder reactor research and development program.

#### AGENCY COMMENTS

The Department of Energy provided written comments and, in summary, disagreed with GAO's position on the question: "Whether or not to build the Clinch River Breeder Reactor Project." For a summary of the Department's comments and GAO's evaluation see page 23. The full text of the Department's comments are included as appendix I.

#### A FINAL COMMENT

GAO did this evaluation because the Congress is again considering whether to fund the Clinch River Breeder Reactor. As stated earlier it is premised on the assumption that the Nation wants to continue a strong liquid metal breeder research and development program. Given that assumption, GAO does believe the weight of the evidence it has seen supports continued funding of the project.

Beyond that assumption, there are two other matters which the Congress must factor into its decision.

First, there is considerable disagreement and concern over the extent to which nuclear power should be pursued as compared to coal, solar, and other energy options. In any event, breeders are the essential ingredient of making nuclear fission a long-term energy source. A decision not to develop breeders implies the phasing out of nuclear fission as an energy source. Exactly when this could occur depends on our ability to recover uranium and further improve the efficiency of light water reactors.

Second, the administration is rigid in its opposition to building the Clinch River Breeder Reactor. Thus, if Congress does continue to fund that project, further efforts will be required to remove the impasse between continued funding and the administration's position in order to assure that the funds authorized and appropriated are productively used.



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## ABBREVIATIONS

AEC	Atomic Energy Commission
CDS	Conceptual Design Study
CRBR	Clinch River Breeder Reactor
DOE	Department of Energy
ERDA	Energy Research and Development Administration
GAO	General Accounting Office
LMFBR	liquid metal fast breeder reactor

## CHAPTER 1

### INTRODUCTION

Before 1973 there were few, if any, restraints on energy consumption in the industrial nations. Traditional fuels-- natural gas, oil, and coal--and hydroelectric power provided cheap energy, and a new electrical energy source-- uranium--rapidly was being deployed to replace oil and gas in the long-term. The oil embargo of 1973-74 and subsequent events, however, made the world painfully aware of the vulnerability of relying on oil for so much of its energy. The short-term effects of the oil embargo were intensified by the recognition that while the world's known oil reserves were rapidly declining, the reliance of industrialized nations, particularly the United States, on oil was increasing. This situation was further aggravated in the United States by the increasing concern over the adverse environmental impacts of mining and burning coal, our most abundant energy resource. It was in this context that domestic utilities and foreign countries increasingly turned to nuclear power in the early 1970s.

Today, 70 commercially owned nuclear powerplants provide about 13 percent of the electricity generated in this country. Another 102 plants are under construction or planned. All but one of these plants are conventional light water-cooled reactors which make relatively inefficient use--1 or 2 percent--of the energy potential in uranium fuel.

From the beginning of the nuclear power program, the Federal Government and nuclear industry recognized that the widespread deployment of nuclear powerplants over an extended time period required more efficient use of our uranium resources. This was to be accomplished by developing a breeder reactor which, in effect, produces more usable nuclear fuel (in the form of plutonium) than it consumes. The plutonium produced in breeder reactors could be used to fuel other breeder reactors and conventional light water-cooled reactors. One type of breeder, the liquid metal fast breeder reactor (LMFBR), promised the most efficient use--60 to 70 percent--of the energy potential in uranium. With breeder reactors, especially the LMFBR type, nuclear energy was seen as having the potential to be a major electrical energy source for several centuries. Without it, nuclear energy could only be counted on until shortly after the end of this century.

## THE ORIGIN AND EVOLUTION OF THE LMFBR PROGRAM

From the beginning of the Federal nuclear power program, the development of the breeder reactor has been a major objective. In 1967, after several years of study, the Atomic Energy Commission (AEC) 1/ selected the LMFBR breeder concept for development and declared it to have the highest reactor development priority. The LMFBR was selected over other breeder types because of its (1) more efficient use of the energy potential in uranium, (2) industrial support, (3) technological experience, and (4) its proven feasibility--six small LMFBRs had been constructed in this country between 1946 and 1963. As originally envisioned, a broad-based LMFBR research and development program would support the cooperative Federal Government/industry construction of a limited number of LMFBR demonstration plants, which in turn would lead to commercial deployment.

Other major industrial nations also decided to develop LMFBR technology. They, like the United States, foresaw the need for an energy source to supplant traditional fuels. These countries have committed substantial resources to developing this energy option on a large scale. For example, the Soviet Union has operated a 350-megawatt 2/ electric plant since 1972 and a 600-megawatt electric plant went into operation this year; France and the United Kingdom have been operating 250-megawatt electric plants since mid-1974. The first step in the United States' breeder demonstration program was to build an intermediate-sized LMFBR near Oak Ridge, Tennessee--the Clinch River Breeder Reactor Plant Project.

### ROLE OF THE CLINCH RIVER PROJECT

In 1970 the Congress authorized AEC to enter into cooperative arrangements with private industry to build and operate the Clinch River project. This project was to demonstrate that a commercial-scale LMFBR could be licensed and operated reliably and safely on a utility electric power supply system. The project's size--about 380 megawatts, electric--was selected as a prudent step toward eventual commercial-size LMFBR powerplants (about 1,000 megawatts, electric).

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1/On January 19, 1975, the research and development part of AEC became part of the Energy Research and Development Administration (ERDA), which in turn became part of the Department of Energy (DOE) on October 1, 1977.

2/A megawatt is 1,000 kilowatts.

Management of the Clinch River project is a cooperative arrangement among DOE (formerly AEC and then ERDA), the electric utility industry, and the nuclear engineering design, manufacture, and supply industry. Two non-profit organizations were formed in 1972 to implement project management. DOE provides major funding support and has complete management authority for the project. The utilities provide project financial support and technical assistance. To date, the utility industry has provided about \$100 million of the \$260 million funding it agreed to commit to the project.

Originally the Clinch River project was expected to be completed and to begin operating in 1980 at a cost of \$700 million. In the early 1970s, however, a number of environmental, technical, and economic issues surfaced which necessitated a reappraisal of the cost and schedule estimates. As a result, by 1974 the scheduled plant operational date had slipped to 1982 and the cost estimate had risen to \$1.7 billion. The demise of AEC and the creation of ERDA brought increased competition for research and development funds, and in a 1976 revised LMFBR program plan, ERDA further slipped the project's operating date to 1983 and revised the cost estimate to \$1.9 billion. The Clinch River project continued under ERDA's revised LMFBR program plan until April 1977.

#### THE CURRENT ADMINISTRATION'S NUCLEAR ENERGY POLICY

On April 7, 1977, the current administration proposed a major redirection in U.S. nuclear energy policies. This included reorienting the LMFBR research and development program from commercial demonstration to laboratory research. Emphasis was placed on examining alternative breeder types which might be more resistant to the possible proliferation of nuclear weapons material.

The new policy was based on the administration's

- concern that worldwide use of plutonium-based nuclear fuels would lead to the proliferation of nuclear weapons,
- projections that commercial breeder reactors were not needed as soon as previously thought because of reduced electrical energy growth forecasts and because of larger estimated uranium resources to fuel conventional light water reactors, and
- the Clinch River project's technical obsolescence, small size, and large costs.

To implement the new policy, the administration decided first to indefinitely defer and then to terminate the Clinch River project.

In place of the construction of the Clinch River project the administration has proposed a conceptual design study for a larger plant, one that would be closer to commercial size (650 to 900 megawatts-electric). The administration has emphasized, however, that its commitment to the conceptual design study is not a commitment to build a larger plant.

If and when a large plant is constructed, DOE officials acknowledge that it (1) could be located on a Federal reservation, (2) will probably be federally funded, and (3) may not be licensed. If the facility is not licensed it is expected that there will be a full safety review by the Nuclear Regulatory Commission but that there will be no public hearings or actual issuance of a license to construct or operate the plant. Like the Clinch River project, the facility is planned to operate on a commercial power generation system.

As yet, the Congress has not agreed to terminate the Clinch River project, and in fact its fate has become the focal point of the controversy over the long-term use of nuclear power in this country. Clinch River project proponents and opponents alike view it as a symbol of a national commitment for future large-scale deployment of both breeder and conventional reactors.

The continuing disagreement between the administration and the Congress on the merits of going forward with the Clinch River project must be resolved soon. The Congress keeps appropriating funds for construction of the project and the administration has continued spending an average of about \$15 million per month on engineering design and major component fabrication activities. But, it has not begun any site preparation or construction activities and has suspended all licensing of the project. This "marching in place" status is leading rapidly to a point where funds appropriated for the project will be wasted.

#### WHAT THIS REPORT DOES

Over the past 5 years or so, we have reported to the Congress on various aspects of the Clinch River project and the LMFBR program. The conclusions of these reports can be summarized as follows.

--There are many uncertainties regarding whether and when LMFBR commercialization is needed.

--The program is still in a research and development stage and the Clinch River project is the next logical step in providing the information needed to make a decision on possible commercialization in the years ahead.

--Building the project does not represent a decision to commercialize the technology.

Therefore, this report analyzes the administration's basis for wanting to terminate the Clinch River project as well as the administration's proposed alternative to it. It must be emphasized that our analysis is aimed at the following issue: "In light of the administration's and Congress' intention to continue a strong LMFBR program, should the Clinch River project be built?"

#### HOW WE DEVELOPED THIS REPORT

We obtained the information in this report by interviewing a wide range of high-ranking Government and private industry individuals and by reviewing documents, studies, reports, correspondence, and other records provided by the organizations listed below and by other interviewed parties.

#### ORGANIZATIONS PROVIDING INFORMATION

##### DISCUSSED IN THIS REPORT

<u>Organization</u>	<u>Location</u>
U.S. Department of Energy, headquarters	
Office of the Assistant Secretary for Energy Technology	Washington, D.C.
Nuclear Energy Programs	Washington, D.C.
Office of Policy Evaluation	Washington, D.C.
U.S. Department of Energy, National Laboratories	
Fast Flux Test Facility Project Office	Richland, Washington
Hanford Engineering and Development Laboratory	Richland, Washington
Clinch River Breeder Reactor Plant Project Office	Oak Ridge, Tennessee
Oak Ridge National Laboratory	Oak Ridge, Tennessee
Argonne National Laboratory	Argonne, Illinois

<u>Organization</u>	<u>Location</u>
<b>Other Government Agencies and Organizations</b>	
Nuclear Regulatory Commission	Washington, D.C.
Office of Management and Budget	Washington, D.C.
Arms Control and Disarmament Agency	Washington, D.C.
White House Domestic Council	Washington, D.C.
Department of State	Washington, D.C.
<b>Utilities</b>	
Commonwealth Edison Company	Chicago, Illinois
Southern California Edison Company	Rosemead, California
<b>Reactor Manufacturers</b>	
Westinghouse, Inc.	Pittsburgh, Pennsylvania
General Electric Corp.	Sunnyvale, California
Atomics International	Canoga Park, California
<b>Nuclear Industry Organizations</b>	
Electric Power Research Institute	Palo Alto, California
Atomic Industrial Forum	Washington, D.C.
<b>Public Interest Groups</b>	
National Resources Defense Council	Washington, D.C.



CHAPTER 2  
ANALYSIS OF THE ISSUE OF WHETHER  
TO TERMINATE THE CLINCH RIVER PROJECT

The administration's position on the Clinch River project is to terminate it and replace it with a conceptual design effort for a much larger plant. This position has been justified on the basis of

- nuclear proliferation concerns,
- a diminished need for commercial LMFBRs, and
- Clinch River project's technical obsolescence, small size, and large costs.

This chapter analyzes this justification and discusses other factors we believe are important concerning whether the Clinch River project should be terminated or completed.

ARE LMFBRs A NUCLEAR PROLIFERATION CONCERN?

Yes, all nuclear reactors that involve the recycling of weapons-grade nuclear material are proliferation concerns. But, terminating LMFBR demonstration in this country accomplishes very little in the area of proliferation if other countries proceed with their LMFBR work.

Under the current administration, nuclear proliferation has received a very high level of attention and concern. The President's statements of April 7, and April 20, 1977, clearly underscored this concern as did the President's veto of the 1978 DOE authorization bill primarily because it contained funds to continue the Clinch River project. The President's nonproliferation initiative stems from national security concerns and reflects a basic belief that early commercialization of LMFBR technology would increase the worldwide pressure to move immediately to a "plutonium economy." In this context, the administration sees the Clinch River project as the first major step toward commercializing the LMFBR.

The administration is now attempting to redirect the LMFBR program from the Clinch River project back into research and development activities of a broader nature. The objective of the redirection is to develop a breeder reactor fuel cycle that would be more resistant to the diversion of

of nuclear materials for nuclear weapons purposes. This objective is being pursued on both the national and international fronts. Nationally, the administration has begun an investigation of alternative nuclear fuel cycles known as the Nonproliferation Alternative Systems Assessment Program. The results of this work will provide United States input to a much broader, concerted effort among 53 foreign countries and 4 international organizations that are trying to find a better answer to the proliferation problems that surround the increased use of nuclear power. This international effort is termed the International Nuclear Fuel Cycle Evaluation. Both studies are scheduled to be completed by March 1980.

The administration believes the credibility of the U.S. nonproliferation efforts could be seriously damaged if the United States constructs the Clinch River project. According to the administration, such action would be seen as reflecting a decision to commercialize LMFBR technology rather than giving serious consideration to alternative approaches.

We agree in principle with the administration's nonproliferation objectives. However, we believe that from strictly a proliferation perspective, the administration's proposal to terminate the Clinch River project and to wait until 1981 before deciding to build a larger breeder reactor plant is not the proper course to follow. First of all, as long as the construction of the Clinch River project is not an irrevocable commitment to commercially deploy LMFBR technology in this country, and we continue to believe that it is not, the United States can continue to use the Clinch River project as a focus for its breeder research and development program.

Secondly, the administration is hoping its position on the LMFBR program and the Clinch River project will influence other nations to delay development of breeder reactors until more proliferation resistant technologies are identified and developed. This does not appear to be working. Despite the administration's urgings, breeder programs are proceeding in several other nations. And, the consensus among those we interviewed was that these other countries--France, Russia, the United Kingdom, Japan, West Germany, and others--will continue to develop their own breeder programs no matter what the United States does with its own.

Furthermore, the large majority of the people we interviewed did not expect the national and international proliferation studies to identify any technology improvements that would be significantly better than current LMFBR concepts. For instance, all nuclear materials capable of sustaining a chain reaction in the various nuclear reactor systems--

uranium-235, uranium-233, or plutonium-239--are usable in their pure forms for fabricating nuclear explosions. Thus, the people interviewed thought it more important to increase emphasis on international safeguards and institutional controls than to rely on the technological development of more proliferation-resistant fuel cycles.

There are indications that the President is downplaying the proliferation argument. For instance, on June 14, 1978, the President met with utility executives to discuss the administration's redirected breeder program. Several of those attending the meeting said the President did not identify proliferation concerns as a major force behind his decision to defer breeder reactor development. In fact, according to several attendees, he said he no longer opposes the Clinch River project for this reason. Subsequently, a White House official told us that while the President did not emphasize the proliferation problem in the June 14 meeting, it is still one of his basic concerns. We believe, however, that the administration considers the Clinch River project's contribution to the nonproliferation problem to be less significant than once thought.

We do not believe that constructing the Clinch River project will undermine the President's nonproliferation initiatives. On the contrary, a strong case can be made that failure to construct the facility would put the United States in a position of weakness by taking away the one aspect of the program that could influence breeder-related decisions being made by foreign countries. For example, a large majority of industry, utility, and research people we interviewed thought that canceling the Clinch River project could weaken this country's ability to exchange breeder reactor information effectively with foreign countries. This country would, at some point, have nothing to offer other countries in exchange for information on their programs. This could compromise our position of leadership and reduce our influence over the development of breeder reactor and fuel cycle programs internationally.

HAS THE NEED FOR COMMERCIAL BREEDER  
REACTORS DIMINISHED?

A definitive answer cannot be given to this question. The administration has proposed a breeder commercialization program that spans about 46 years of development, and has made a series of long-term projections in the areas of electrical energy demand, uranium resources, and breeder economics that support its proposal. However, the inherent imprecisions of these forecasts underscore the

need to take the prudent and logical step of constructing the Clinch River project.

In January 1977, ERDA called for demonstrating LMFBR technology in the early 1980s so that a decision on commercializing the technology could be made in 1986. The previous administration believed that this decision was needed by 1986 because it forecasted that about 1,000 reactors would be needed by the year 2000 to meet expected electrical energy demands.

This forecast, however, proved to be much too high. In the years following the 1973-74 oil embargo, electrical energy growth rates declined as did the number of conventional nuclear reactors planned by utilities. In fact, many nuclear reactor orders were canceled. Projections for installed nuclear generating capacity through the year 2000 declined substantially, calling for a reassessment of the time when commercial breeder reactors might be needed. Considering these factors, the current administration has concluded that sufficient uranium is available to fuel conventional light water reactors for many more years than previously thought and that, consequently, the first commercial breeder reactors would not be needed until around 2025. Thus, the administration believes a commitment to build a facility to demonstrate breeder technology would not be needed until the 1980s. Accordingly, the administration has proposed that such a commitment be delayed for 2 years, until March 1981. According to administration spokesmen, the March 1981 decision point would allow for LMFBR commercialization by about 2025, 46 years from now, and would be consistent with its long-term energy demand, uranium resource, and economic projections.

As recent experience has demonstrated, however, energy demand forecasting is not very reliable. Moreover, administration projections concerning the amount of uranium resources available to support the water-cooled reactors and on the contributions of unproven nuclear and nonnuclear energy technologies to the estimated uranium resource base add to this uncertainty. Further, the long-term economic attractiveness of LMFBRs is largely dependent on the impact these uncertainties have over the next 20 to 40 years.

In determining that commercial breeders would not be needed until 2025 or later, DOE not only made projections and assumptions about energy supply and demand, it also made assumptions and projections on the steps and time needed to develop the LMFBR program to a commercial status in the next 45 years.

### Uranium supply estimates

Many projections have been made on the amount of uranium in this country. In 1978 DOE estimated that about 4.4 million tons of uranium probably were available for mining in this country, including .9 million tons of proven reserves, 1.4 million tons of probable resources, possible discoveries totaling 1.5 million tons, and speculative discoveries totaling 0.6 million tons. This DOE estimate, if accurate, tends to support the administration's position that commercial breeder reactors will not be needed until around the year 2025. Other studies project higher and lower amounts. Most knowledgeable sources agree only with DOE's proven reserves data.

There are strong differences of opinion on the amount of possible and speculative resources that may be found. For instance, in a 1978 study the National Academy of Sciences reported that as a basis for prudent planning, a figure of 1.8 million tons of uranium ore should be used. The Academy stated that there is a 97 percent probability that U.S. uranium resources are less than DOE's 1977 estimate, which are lower than DOE's 1978 figures. This difference of opinion is significant because the proven reserves identified by DOE are adequate only to meet the lifetime fuel requirements for nuclear plants which are already built or committed for construction. Further, a recent GAO study concluded that DOE may have overestimated the domestic uranium resource base by as much as 20 percent by not recognizing losses incurred in the processing of uranium ore into nuclear fuel. 1/

### Extending uranium resource base

DOE plans to do research and development to increase the fuel efficiency of conventional water-cooled reactors 15 percent by 1988, and another 15 percent by the year 2000. DOE believes this can extend uranium fuel resources about 5 to 8 years. Also, DOE plans to introduce reactors more advanced than current water-cooled plants during the next 10 to 20 years. Though these would not be breeder reactors, DOE estimates that introduction of more fuel efficient advanced reactors by 1995 could stretch uranium resources by an additional 3 to 7 years. Further, DOE is developing new uranium enrichment techniques that, if successful, can stretch existing uranium resources even more.

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1/GAO letter report to the Secretary of Energy dated April 10, 1979, (EMD-79-50).

We found a general consensus that (1) improvements can be made in the fuel efficiency of conventional water-cooled reactors and (2) advanced reactors can also help the United States use its uranium more efficiently. Additionally, virtually everyone we interviewed thought that improved uranium enrichment techniques could further augment the Nation's uranium supplies.

However, our review also showed that officials of both industry and Government believe that DOE's projected 30 percent increase in uranium fuel efficiency by the year 2000 was optimistic. They also did not think these improvements would significantly affect the timing for commercial LMFBR deployment. In fact, a former director of DOE's LMFBR program said that such improvements would only extend domestic uranium fuel supplies by about 5 years. He did not think this was adequate to affect the timing of commercial LMFBRs. We found a similar body of opinion regarding the contributions of advanced reactor facilities; that is, their ability to significantly extend uranium resources remains to be proven and must now be viewed as uncertain. A similar argument can be made for the contributions that can be made by advanced uranium enrichment techniques.

#### Economics of commercial LMFBRs

The economic attractiveness of commercial LMFBRs relative to other reactor concepts is primarily dependent on the price of uranium fuel, the capital costs to construct an LMFBR, and the growth rate of nuclear power. Thus, the economic attractiveness of commercial LMFBRs varies greatly depending on the assumptions that are made about how much uranium resources are available, how efficiently they are utilized, how much LMFBR construction costs prove to be, and the growth rate of nuclear power in this country. The timing of LMFBR commercial deployment is directly related to the assumptions that are made. DOE has recognized this in a recently published draft "The Nuclear Strategy of the Department of Energy," dated April 1979. This DOE strategy paper concludes that commercial breeders will probably not be needed until after 2025, at which time they will be economically competitive with other reactor concepts. This analysis is consistent with the administration's decision to terminate the Clinch River project and to delay the decision to build a demonstration project for 2 or 3 years.

However, the uncertainties that surround all of the key variables that impact on LMFBR economics indicate that the path chosen by the administration could be risky. Depending on the assumptions made about the factors impacting on LMFBR

economics the date of economical LMFBR commercial deployment can be altered significantly.

IS THE CLINCH RIVER PROJECT TOO SMALL  
AND TECHNICALLY OBSOLETE?

It is not technically obsolete and its intermediate size is a logical and prudent step in developing LMFBR technology. Other countries have recognized this and included similarly scaled facilities in their LMFBR programs.

In vetoing the fiscal year 1978 DOE authorization bill, the President stated that the Clinch River project, when completed, would be technically obsolete. This and similar statements by other administration spokesmen have been used to support the argument that the Clinch River project should not be built. Based on our discussions with a broad range of people in industry and Government, we were unable to find support for this statement. No one we talked with was able to provide us with any specific facts indicating that any components or design features were obsolete. On the contrary, the majority opinion of the most recent Government study of this issue, completed in April 1977, noted that the project's design had been continually updated since 1972 and represented the latest in LMFBR technology. Further, DOE officials responsible for nuclear energy programs were unable to provide support for the President's argument that the project was obsolete and did not wish to comment on the validity of the argument.

One particular area of controversy is the question of reactor core design. Specifically, the administration has questioned the wisdom of the project's current loop design versus the pool design. The loop versus pool terminology refers to the manner in which the facility's liquid sodium coolant is contained within the reactor.

We found the overwhelming consensus to be that either design approach has merits and that neither is clearly superior for safety, economic, or environmental reasons. Further, in February 1977 the Nuclear Regulatory Commission issued its final environmental impact statement on the construction and operation of the Clinch River project. It concluded, among other things, that "the staff's review of these two concepts has led to the conclusion that the choice of a pool design would not provide any substantial advantage."

The size of the Clinch River project also has been used by administration officials to support its termination. According to administration officials, its 380 megawatt size

is too small to provide the information and operating experience needed for the larger scale plant if and when the technology is commercialized. Moreover, it is argued that building the smaller project at this time will place the U.S. program too far behind the foreign competition in case a decision is made to commercialize the technology.

After interviewing a wide range of knowledgeable industry, Government, and private individuals on this subject, we found that the intermediate size of the Clinch River project is a necessary step in making the LMFBR technology a viable and timely option for future nuclear energy supply. The size represents a logical and prudent step in the scaleup of LMFBR reactor facilities. The administration's proposed redirection of the LMFBR program, while requesting a termination of the Clinch River project, calls for certain project component design and testing activities to be continued for possible use in a larger plant. According to DOE officials, these activities will provide important information and experience that can be applied to a larger facility. Moreover, DOE officials told us that this component testing and fabrication information will apply to all key areas of the technology that would be needed to design and construct the next larger plant. However, we learned from industry officials and technicians involved in the fabrication and testing of LMFBR components, there is no reasonable substitute for testing components in an operating reactor environment. Further, these same people informed us that the most reliable way to fabricate and test these components was in progressively larger steps. The scaleup to a Clinch River project size facility, in their judgment, represented the most reasonable and prudent step in this process. The April 1977 majority report of the LMFBR Steering Committee of ERDA also reflected these views. This was again reinforced in March 1979 in a report prepared by a DOE sponsored study group headed by the Westinghouse Corporation.

It is difficult to refute the arguments presented to us by the individuals we interviewed and the technical reports we reviewed. These positions are reinforced by the approach this country followed in developing the light water reactor industry and by foreign nations in developing the LMFBR programs. In both instances the programs relied on a gradual scaleup of plants. For example, the LMFBR programs of Russia, France, the United Kingdom, and Japan include intermediate-size plants similar to the Clinch River project.



ARE THERE ANY RISKS ASSOCIATED WITH  
DEVELOPING LMFBR TECHNOLOGY WITHOUT  
BUILDING THE CLINCH RIVER PROJECT?

While skipping the Clinch River project for a larger plant does not raise significant safety issues, the potential economic consequences and reduced public confidence in the safety of the larger plant could inhibit future efforts to commercialize LMFBR technology.

One of the questions we asked during our review was,

"Are these increased risks associated with building a large breeder demonstration plant without the benefit of the Clinch River project construction and operating experience?"

The almost unanimous answer was that there are no major safety or technological reasons why the large plant cannot be built without first building an intermediate-size plant.

Most people felt that enough was known about the safety of LMFBRs because of information gained on past research and demonstration projects (including the Clinch River project) and because of the general applicability of light water reactor technology to breeder technology. There was also increased confidence in LMFBR safety as a result of our tie-in to foreign breeder demonstration projects similar in size to the Clinch River project. As an example, the Director of the Nuclear Regulatory Commission's Office of Nuclear Regulatory Research told us that much more is known about LMFBR safety today than was known about light water reactors at a similar stage of development. Although the LMFBR has unique safety problems, he felt that these problems were understood well enough to permit the construction of the larger plant. These thoughts were echoed by most other industry and Government sources.

These people pointed out, however, that extra conservatism will have to be engineered into the large plant design. This will likely result in additional safety features, more stringently designed hardware, and more conservative operating procedures, all of which add costs to the project. Also, they felt that if the Clinch River project was not completed, the large plant would likely experience more component failures and operating problems and that this could seriously affect the economic success of the project.

If and when the administration commits itself to the construction of the large demonstration plant, it is recognized

that it (1) could be located on a Federal reservation (Hanford, Washington is preferred), (2) will probably be completely federally funded and managed, (3) may not be licensed, and (4) will generate electric power on a commercial electricity grid. DOE officials explained that if the facility is not licensed the Nuclear Regulatory Commission would conduct a full staff and Advisory Committee on Reactor Safeguards safety reviews but there will not be Nuclear Regulatory Commission public hearings, environmental review, or issuance of a license to construct or operate the plant. According to DOE officials, this procedure was successfully followed on the Fast Flux Test Facility. They said the procedures will permit the Nuclear Regulatory Commission to develop many of the licensing standards that will be needed if breeders are commercially deployed.

Nuclear Regulatory Commission officials could see no advantage to the informal safety review approach over formal licensing proceedings. In this regard, utilities and nuclear industry representatives we interviewed had serious reservations about the possibility that DOE will build the large plant on a Federal reservation and not subject it to the scrutiny of the Nuclear Regulatory Commission's full licensing process. In the utilities' view, licensing the construction and operation of a breeder reactor is the most formidable hurdle that must be crossed in demonstrating breeder technology.

Another concern, and one we share, is the negative impact this retreat from public scrutiny might have on public confidence in and acceptance of breeder reactors. The utilities believe that in the present climate of public concern and debate on nuclear safety, the DOE plan is not appropriate. The recent accident at the Three Mile Island nuclear powerplant has intensified this concern and debate over nuclear reactor safety. In this case, a water-cooled reactor, designed and constructed after a long series of gradual reactor scaleups experienced unanticipated events that resulted in releases of radioactive materials and serious reactor core damage. This event underscores the utilities' point that today and for the foreseeable future, gaining early public confidence and acceptance may be difficult but are as important as establishing technical and economic viability.

WHAT EFFECTS WOULD TERMINATING THE  
CLINCH RIVER PROJECT HAVE ON  
UTILITIES AND NUCLEAR SUPPLIERS?

Utilities may end active participation in breeder reactor development and nuclear suppliers'

component design and fabrication capabilities may decrease significantly.

#### Effects on utilities

Utilities have been actively and directly involved with the LMFBR program at least since 1963 when the small (61 megawatt-electric) Fermi breeder reactor began operating near Monroe, Michigan. In 1970, after the Congress authorized an LMFBR demonstration plant project, utility advisory boards assisted AEC in developing project objectives and plant design objectives and approaches. Utilities and nuclear component suppliers have pledged about \$260 million in support of the Clinch River project. If the project is terminated, utilities are likely to lose confidence in the Federal Government's commitment to the LMFBR and choose not to participate financially in future DOE breeder demonstration projects. For example, an executive vice president of a major utility participant said his company definitely would not participate in any large size plant project substituted for the Clinch River project. In his company's view, the risks of failure--particularly in terms of gaining public confidence in, and acceptance of, breeder reactors--are too great without a fully licensed and regulated intermediate-size demonstration plant.

#### Effects on nuclear suppliers

Over the past 30 years, the United States has developed the basic facilities, services, equipment, and installations for designing and fabricating breeder reactor systems and components. If the hardware-oriented Clinch River project is terminated in favor of a conceptual design study and possible administration commitment sometime in the 1980s to building a large-size breeder reactor, there is a distinct possibility that this infrastructure will have significantly dissipated by the time the commitment is made.

The administration downgrades this possibility, and maintains that its proposed conceptual design study project will in fact hold together a large part of the present Clinch River project design team. Administration officials told us that loss of the breeder reactor industrial infrastructure is not a real issue; when the time comes to build a demonstration plant, industry will respond. Without exception, industry representatives we interviewed disagreed. They said they are already losing experienced people because of the perceived negative administration positions on the breeder reactor and nuclear power. The Clinch River project reactor manufacturers told us that under the conceptual design study proposal they may have to lay off or reassign up to 70 percent of the people they now have assigned to the project.

The biggest loss of the breeder reactor infrastructure, however, may occur in the nuclear industry segment which has been developed to supply the many systems and components in the reactor concept. In the current uncertain breeder reactor atmosphere, and without a hardware-oriented project for 2 to 5 years more, these suppliers may turn their attention and industrial resources to other businesses.

How long it would take to put the breeder reactor infrastructure back together is open to speculation. In part, it would depend on when a decision is made to build the demonstration plant. Industry representatives estimated that it could take 10 to 20 years to reassemble the necessary talent and manufacturing capabilities to build a commercial-size breeder reactor. This would, in their view, jeopardize utilities' ability to deploy commercial reactors as early as they might be needed.

HOW MUCH WILL IT COST TO CONSTRUCT  
OR TERMINATE THE CLINCH RIVER  
PROJECT?

It will cost the Federal Government about \$1.292 to \$1.491 billion more to build the project than it will to terminate it. The range in this estimate reflects the uncertainty of the costs the Government may incur if the project is terminated.

It is now estimated that the total cost to complete the Clinch River project will be about \$2.643 billion. This is an increase of about \$1.9 billion over the original estimate of \$700 million. A recap of the Federal costs to complete the project follows.

	<u>DOE COSTS TO COMPLETE PROJECT</u> (billions of dollars)
Total estimate project cost	\$2.643
Less: Industry share	<u>.327</u>
DOE cost	2.316
Less: Estimated DOE expenditures thru September 30, 1979	<u>.674</u>
Remaining DOE cost to complete project	<u>\$1.642</u>

If the Congress chooses to terminate the Clinch River project at the end of this fiscal year, however, the remaining Federal commitment will be between \$151 and \$350 million. The higher figure reflects estimates by some industry groups and depends on the results of lawsuits that may be brought against DOE for failing to complete the project. In addition, it is also very unclear as to what benefit the Government will derive from the \$674 million it will have put into the project by the end of this fiscal year. If the project is terminated, much of the the money spent to date may be wasted. Although there is some residual value to be gained from the money spent to date, very little will be proven about LMFBR technology or state-of-the-art without the construction and operation of the project.

The \$1.9 billion increase in total estimated project cost has been used by the administration and critics of the LMFBR program as evidence that the Clinch River project is not cost beneficial and is no longer justified. However, much of the cost increases are attributable to factors beyond the control of the project management. It has been estimated that over \$700 million of the estimated cost increase was cost escalation that occurred during the project's lifetime. However, a large portion of this amount occurred during the early project development stage. We found one estimate to be as high as \$560 million. Another \$410 million is attributable to the current stalemate over whether the project should be continued. These two factors account for over \$1.1 billion or well over 50 percent of the total cost increase.

Another key element is that one-third of the total project cost, or about \$830 million, represents first-of-a-kind project costs since off-the-shelf items are not yet yet available. Thus, these costs represents more of a research and development cost rather than Clinch River project costs.

### CHAPTER 3

#### CONCLUSIONS, OBSERVATIONS, AND

#### EVALUATION OF DOE'S COMMENTS

The Congress and the administration are on record supporting a strong LMFBR research and development program. However, for several years they have been in a stalemate over the role of the Clinch River project in that program. This stalemate is a growing concern because funds the Congress has been appropriating for the project are being used to keep it in a status quo or "marching in place" posture.

As we have concluded in earlier reports, the fate of the Clinch River project should be deliberated for what it is, a demonstration facility for a program in the research and development stage which would provide essential information needed to make a future decision on possible commercialization of breeder reactor technology.

This year the Congress must again decide whether to continue or terminate the Clinch River project. We analyzed the issues and positions which bear on the question for the purpose of helping the Congress in that decision.

The weight of evidence supports continuing the Clinch River project if this Nation wishes to maintain a strong LMFBR program. Terminating the project would have significant repercussions on the entire LMFBR program and would raise serious questions about the future of the program. The basis for our conclusions are:

--One of the administration's reasons for wanting to terminate the Clinch River project is its belief that commercial breeder reactors will not be needed until about the year 2025 which is 25 years later than thought several years ago. Although commercial breeder reactors may not be needed as soon as earlier projected, when they could be needed depends on variables such as electricity growth rates, domestic uranium reserves, and successful research, development, and demonstration of other nuclear and nonnuclear technologies. The uncertainties surrounding these variables as well as the uncertainties of the breeder program's content and pace for the next 45 years argues for continuing the effort to demonstrate breeder reactor technology.

--The project is not an irrevocable step toward commercial deployment of LMFBR-type breeder

reactors. It is a logical extension of the LMFBR research and development program which, if completed, could provide valuable information on breeder reactor licensing, construction, and operation and serve as a basis for future decisions on whether the technology should be commercialized.

- Terminating the project will not reduce proliferation risks. In fact, termination could reduce this Nation's ability to influence breeder reactor safety and safeguard concerns worldwide. Furthermore, if desirable at some future time, the Clinch River project can be used to test alternative proliferation-resistant fuel cycle concepts while continuing to provide valuable liquid sodium technology operating experience.
- The Clinch River project represents a prudent extrapolation in size of breeder reactor technology. Proceeding directly to a near-commercial size plant, while technically feasible, would present risks in the areas of plant reliability and public acceptance of breeder reactor technology.
- The Clinch River project design is current. We find no support for the often stated administration view that the project is technically obsolete.
- Completing the project will cost another \$1.6 billion. Terminating it will cost \$151 to \$350 million in addition to the \$674 million already spent (much of which might be wasted). The cost difference between completing the project or terminating it with such a large potential waste of funds is small in comparison to the experience that can be gained now instead of at some undetermined future time.

During the past 5 years, we have reported to the Congress on various aspects of the Clinch River project and LMFBR program. A major conclusion we reached in these reports was that the Clinch River project is a logical extension of the LMFBR program's research and development effort. Our current report resulted from our belief that a reexamination of the issue would be useful especially in view of the administration's new proposal for a larger plant.

The administration's conceptual design study for a large plant alternative is not based on a technical reevaluation of the best way to proceed with the breeder reactor program. There are, we believe, many aspects of the proposal which need deliberate consideration by the

administration, the Congress, nuclear suppliers, and the utilities which would use breeder reactors. They include:

- Can a conceptual design study provide proper focus for the LMFBR program when for the last decade this program has been driven by the hardware-oriented Clinch River project? Can the conceptual design study, to be completed in 1981, continue to provide a focus for the LMFBR program until a decision is made to design and construct a breeder reactor? Some industry representatives we interviewed said the study does not now, and certainly will not in the 1980s, provide focus for an efficient and effective LMFBR program.
- Will the industrial infrastructure be available when needed to design, fabricate components, and build the large plant? To the extent that it may need to be re-established, what will the costs be? Industry representatives told us they have already begun to lose LMFBR talent, they will lose even more if the Clinch River project is terminated, and suppliers will turn their resources to other businesses.
- What is the purpose of the proposed large plant? DOE says it will be a developmental--not demonstration--plant. It will probably be totally Government funded and controlled, it may be built on a DOE reservation, and may not be licensed. Yet, the plant would be near-commercial size, be operated on a utility electric power grid, and would be constructed and operated to confirm the technical and economic feasibility of breeder technology.
- Is it prudent to construct and operate on a utility grid, a near-commercial size breeder reactor without benefit of intermediate scaleup and without subjecting the project to Nuclear Regulatory Commission and public scrutiny by means of the Nuclear Regulatory Commission licensing process? DOE may subject the project to informal and nonbinding Nuclear Regulatory Commission staff safety review only. The purpose would be to make the plant "licensable" and to assist the Nuclear Regulatory Commission in developing breeder reactor licensing standards and expertise. Nuclear Regulatory Commission officials could see no advantage to this approach, however, over the formal licensing proceedings of the Clinch River project. More important, however, putting the plant on a DOE reservation and not subjecting it to full licensing



review is likely to have a large negative impact on public confidence and acceptance of breeder reactors.

A logical and well-conceived program for breeder development and demonstration based on the progressive scaleup and demonstration of the safety and economic viability of the breeder reactor and supporting fuel cycle technologies has already been established. Continuing this program does not irrevocably commit the United States to wide-scale deployment of commercial breeder reactors nor does it mean that the United States cannot be committed to its nonproliferation initiatives; it does, however, permit the orderly development of a major energy technology through the demonstration phase. The experience that can be gained now and in the future by demonstrating LMFBR technology, through the Clinch River project, will prove invaluable at some future time.

The recent accident at the Three Mile Island nuclear powerplant at Middletown, Pennsylvania, underscores the need for prudent and deliberate progress in developing nuclear fission or any other potentially dangerous technology. Licensing, constructing, and operating an intermediate size breeder reactor now is an appropriate step in perhaps demonstrating at some future time to utilities; the nuclear supply industry; and most important, to the public; that breeder reactors can be operated safely, reliably, and competitively with other energy technologies. Thus, if a strong LMFBR program continues to be a national goal, the information gathered by us in the review clearly supports the view that the Clinch River project should be completed as originally planned.

#### DOE COMMENTS AND OUR EVALUATION

DOE provided us written comments on this report. We made several changes to the report to reflect more accurately certain information. The thrust of DOE's comments, however, is that GAO has not done an adequate analysis but presents a view advocating the early commercialization of LMFBR technology. By contrast, our purpose was to analyze the administration's basis for wanting to terminate the Clinch River project as well as the administration's proposed alternative to it. It must be emphasized that our analysis was aimed at the following issue: "In light of the administration's and Congress' intention to continue a strong LMFBR program, should the Clinch River project be built?" This section contains our response to DOE's major comments. The full text of DOE's comments is included as appendix I.

## DOE comment

### Non-proliferation

"The GAO concludes \* \* \* that termination of CRBR in this country accomplishes very little in the area of non-proliferation. Apparently this conclusion was reached without consideration of the views of the Department of State, the non-proliferation policy staff of the Department of Energy, and the National Security Council.

"Without addressing in a substantive manner the analyses developed by those organizations, the GAO report contains serious bias. Further, the arguments advanced \* \* \* do not reflect an adequate appreciation of the non-proliferation views of the Arms Control and Disarmament Agency."

### Our evaluation

We believe that the scope of the work done in support of our non-proliferation analysis was adequate. We obtained the views of the primary Federal agency--the Arms Control and Disarmament Agency--charged with assessing the proliferation impact of all major nuclear activities in this country including the Clinch River project. Moreover, we reviewed a wide range of other administration documents, reports, and pronouncements on this issue including those from the Department of State and DOE.

Further, after receiving DOE comments on the report we contacted officials of the Department of State and were informed that their views are the same as those of the Arms Control and Disarmament Agency. It must be pointed out that (1) DOE's comments do not indicate what, if any, non-proliferation accomplishments have been made and (2) DOE officials told us on May 2, 1979, that, in their view, non-proliferation is no longer the major reason for justifying termination of the Clinch River project.

## DOE comment

"Timing of Breeder Introduction. GAO concludes \* \* \* that uncertainty surrounds the timing of breeder commercialization. This is quite true. But GAO goes on to conclude that '... it would be a sounder policy to take the more conservative position of construction of the Clinch River project.' This conclusion is seriously flawed on three bases. First, it fails to consider the

evidence that, despite the uncertainty, early introduction of the breeder is only justifiable under extreme assumptions concerning: (a) high rates of growth for light water reactors; (b) failure of attempts to improve the uranium efficiency of the once-through fuel cycle; (c) low capital costs for the breeder reactor; and (d) severe limitations on the availability of uranium ore. All of this has been analyzed in 'The Nuclear Strategy of the Department of Energy, DOE/ER-0025-D.' Although the GAO report cites this publication, it does not address this analysis on its merits."

"Second, it is not obvious that the building of CRBR is in any sense more 'conservative' than undertaking a detailed design study for a new, technically superior plant to make breeder technology available when needed. Third, the mere presence of uncertainty is not in itself reason to adopt the most 'conservative' approach. One must analyze the relative probability of the outcomes which would favor earlier breeder deployment and those which would favor a later breeder deployment. GAO has failed to do this."

#### Our evaluation

The weight of the evidence we gathered is in basic disagreement with DOE on this point. This evidence indicates that the LMFBR program should be carried on through a series of logical, prudent steps designed to learn whether the concept is viable. Further, these steps should be taken at a pace that assures the vitality and continuity of the program.

By contrast, DOE is taking the position that it can reasonably project energy demand and supply for the next 45 years and can base its breeder program on that projection. It has, therefore, decided to terminate the current step in the program and spend several years deciding what the next step should be.

Also, DOE has criticized us for not addressing the merits of its analysis made in a draft nuclear strategy publication issued in April 1979. Contrary to DOE's view, we did analyze the publication and do cite its analysis. It should be pointed out, however, that this publication was issued 2 years after the decision was made to terminate the Clinch River project.

## DOE comment

"Character of the Large Breeder Project. In this section \* \* \* the GAO seriously misrepresents the Administration proposal. The report states that the output of a Conceptual Design Study (CDS) is to be a design for a large demonstration plant which will generate commercial power. GAO then observes that such a plant should be licensed and cites in great detail the difficulties arising from an unlicensed demonstration. In fact, the proposed CDS is to design a large test reactor which would be optimized for R&D rather than commercial demonstration.

"This error is carried through to GAO's conclusion. \* \* \* the report concludes, 'In spite of the lessened urgency (to build a breeder demonstration plant), the Administration's large plant alternative could result in a more rapid demonstration and commercial deployment of LMFBR's than if the Clinch River project was completed.' This, of course, mistakenly presumes that the CDS will result in an immediate commitment to build a new plant and further mistakes the purpose of the new plant to be that of demonstrating a commercial reactor. But even if it were true, this argument directly contradicts the 'conservatism' argument made earlier by GAO."

## Our evaluation

The substance of this comment rests primarily on our choice of words used to discuss DOE's conceptual design study. We made several minor word changes to reflect more precisely the administration's proposal as we now understand it.

We would like to point out, however, two inconsistencies in DOE's comment. First of all, DOE infers that it would commit billions of tax dollars to a near-commercial size LMFBR plant for only research and development purposes. Frankly, it is not likely that the construction of such a plant would be seriously considered without commercialization as the prime motivation. As such, it would be reasonable for the commercial utility and construction industry to be closely tied to the project and the Nuclear Regulatory Commission to have the major role in assuring the safety and licensability of the plant. If DOE objects to this, it is either denying the realities of the situation

or has no intentions of moving forward to construct the large plant.

Secondly, DOE calls our report inconsistent on the issue of the timing of the project within the LMFBR program. If there is an inconsistency, it is in DOE's policy on LMFBR development. For example, DOE officials told us that the Clinch River project should be terminated because commercial LMFBRs are not needed as soon as once thought--we have time to make a decision. These same officials argued, however, that the Conceptual Design Study was a logical substitute for Clinch River because it includes a large, near-commercial size plant. This, according to the officials, could help the United States catch up with foreign countries and commercialize the breeder on a "crash basis" if DOE's projections on energy demand and the need for LMFBRs are wrong.

#### DOE comment

"In summary, the GAO paper purports to be an analysis of the issues and positions which bear on the question, "Whether or not to build the Clinch River Breeder Reactor." We find the report devoid of any such analysis. In fact, it appears to be a biased compendium of opinion which does little to support informed Congressional consideration of the issue.

#### Our evaluation

We do not agree. Our analysis and conclusions are the product of numerous discussions with parties knowledgeable of the LMFBR program and our review of many relevant reports, studies, and documents.

Based on these discussions and records reviewed, we found little evidence to support the validity of the administration's justification for its position. In fact, this evidence indicates that the administration's position has constantly shifted over time. For example, in April 1977 the administration said it wanted to terminate the project primarily for proliferation reasons. But DOE tells us this reason is now not nearly as important. Now the major reasons--as stated in an April 1979 draft study--is that commercial breeders will not be needed as early as once thought. Other justifications, such as cost, technical obsolescence, and plant size, have periodically been put forth by administration spokesman with little or no analysis to support them.

The administration's exact position on the Clinch River project was made clear to us by DOE officials in a May 2, 1979, meeting on our draft report. The DOE spokesman on the Clinch River project said he wanted to make it clear that under no circumstances would this administration build the project. We believe such a rigid position makes an objective analysis difficult.

#### A FINAL COMMENT

GAO did this evaluation because the Congress is again considering whether to fund the Clinch River Breeder Reactor. As stated earlier it is premised on the assumption that the Nation wants to continue a strong liquid metal breeder research and development program. Given that assumption, GAO does believe the weight of the evidence it has seen supports continued funding of the project.

Beyond that assumption, there are two other matters which the Congress must factor into its decision.

First, there is considerable disagreement and concern over the extent to which nuclear power should be pursued as compared to coal, solar, and other energy options. In any event, breeders are the essential ingredient of making nuclear fission a long-term energy source. A decision not to develop breeders implies the phasing out of nuclear fission as an energy source. Exactly when this could occur depends on our ability to recover uranium and further improve the efficiency of light water reactors.

Second, the administration is rigid in its opposition to building the Clinch River Breeder Reactor. Thus, if Congress does continue to fund that project, further efforts will be required to remove the impasse between continued funding and the administration's position in order to assure that the funds authorized and appropriated are productively used.



Department of Energy  
Washington, D.C. 20585

May 4, 1979

Mr. J. Dexter Peach  
Director, Energy and Minerals Division  
United States General Accounting Office  
440 "G" Street, N.W.  
Washington, D.C. 20548

Dear Mr. Peach:

Thank you for the opportunity to review your April 30 draft report on "The Clinch River Breeder Reactor - Should the Congress continue to fund it?" Although we have had only two days to review it, it is clear that this report contains serious deficiencies. Left uncorrected, these deficiencies would result in a misleading report which would not contribute to an informed policy discussion. The following are the most noticeable flaws which we observed in our initial review.

Non-Proliferation

The GAO concludes (pp. 10-14) that termination of CRBR in this country accomplishes very little in the area of non-proliferation. Apparently this conclusion was reached without consideration of the views of the Department of State, the non-proliferation policy staff of the Department of Energy, and the National Security Council.

Without addressing in a substantive manner the analyses developed by those organizations, the GAO report contains serious bias. Further, the arguments advanced on pages 10 through 14 do not reflect an adequate appreciation of the non-proliferation views of the Arms Control and Disarmament Agency.

Timing of Breeder Introduction. GAO concludes (pp. 14-19) that uncertainty surrounds the timing of breeder commercialization. This is quite true. But GAO goes on to conclude that "... it would be a sounder policy to take the more conservative position of construction of the Clinch River project." This conclusion is seriously flawed on three bases. First,

[See GAO note, p. 31.]

it fails to consider the evidence that, despite the uncertainty, early introduction of the breeder is only justifiable under extreme assumptions concerning: (a) high rates of growth for light water reactors; (b) failure of attempts to improve the uranium efficiency of the once-through fuel cycle; (c) low capital costs for the breeder reactor; and (d) severe limitations on the availability of uranium ore. All of this has been analyzed in "The Nuclear Strategy of the Department of Energy, DOE/ER-0025-D." Although the GAO report cites this publication, it does not address this analysis on its merits.

Second, it is not obvious that the building of CRBR is in any sense more "conservative" than undertaking a detailed design study for a new, technically superior plant to make breeder technology available when needed. Third, the mere presence of uncertainty is not in itself reason to adopt the most "conservative" approach. One must analyze the relative probability of the outcomes which would favor earlier breeder deployment and those which would favor a later breeder deployment. GAO has failed to do this.

Character of the Large Breeder Project. In this section (pp. 22-25) the GAO seriously misrepresents the Administration proposal. The report states that the output of a Conceptual Design Study (CDS) is to be a design for a large demonstration plant which will generate commercial power. GAO then observes that such a plant should be licensed and cites in great detail the difficulties arising from an unlicensed demonstration. In fact, the proposed CDS is to design a large test reactor which would be optimized for R&D rather than commercial demonstration.

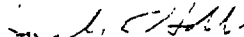
This error is carried through to GAO's conclusions. On page 32 the report concludes, "In spite of the lessened urgency (to build a breeder demonstration plant), the Administration's large plant alternative could result in a more rapid demonstration and commercial deployment of LMFBR's than if the Clinch River project was completed." This, of course, mistakenly presumes that the CDS will result in an immediate commitment to build a new plant and further mistakes the purpose of the new plant to be that of demonstrating a commercial reactor. But even if it were true, this argument directly contradicts the "conservatism" argument made earlier by GAO.

Technical Judgments. We know of no objective technical opinion that the CRBR represents the design which would demonstrate commercial breeder technology in 2020, the earliest that commercial breeder reactors are likely to be needed. There is little factual basis for the GAO opinion that "...the Clinch River project should be deliberated for what it is, a demonstration facility that will provide the Nation with an off-the-shelf energy supply technology." We do not believe that a 380 MWe plant designed in the early 1970's will represent the best "off-the-shelf" technology for the early decades of the next century.



In summary, the GAO paper purports to be an analysis of the issues and positions which bear on the question, "Whether or not to build the Clinch River Breeder Reactor." We find the report devoid of any such analysis. In fact, it appears to be a biased compendium of opinion which does little to support informed Congressional consideration of the issue.

Sincerely,

  
Jack E. Hobbs  
Controller

GAO note: Page references in this appendix refer to the draft report and do not necessarily agree with the page numbers in this final report.

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