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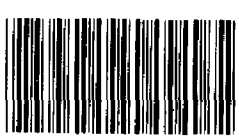
STATEMENT OF
J. DEXTER PEACH, DIRECTOR
ENERGY AND MINERALS DIVISION
BEFORE THE
SUBCOMMITTEE ON ENERGY RESEARCH AND PRODUCTION
HOUSE COMMITTEE ON SCIENCE AND TECHNOLOGY
ON
URANIUM SUPPLY AND DEMAND ESTIMATES

Mr. Chairman and Members of the Subcommittee:

We appreciate the opportunity to be here today to discuss the outlook for uranium supply and demand, and the relationship that outlook has to the issues bearing on strategies for the Nation's breeder reactor development program.

While GAO has issued numerous reports over the years on uranium supply and demand and on breeder reactor issues, my testimony today will focus on two recent reports. One is an April 10, 1979, letter report to the Secretary of Energy (EMD-79-50) which states that Department of Energy (DOE) estimates of uranium requirements on the resource base are understated by as much as 20 percent because its current method of analysis neglects milling losses that are experienced in extracting uranium from uranium ore.

The other is a May 7, 1979, report to the Congress entitled, "The Clinch River Breeder Reactor--Should The Congress Continue to Fund It?" (EMD-79-62). That report



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Testimony
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addressed a number of issues bearing on the funding of the Clinch River project, including the question of uranium resources available for fueling the current generation of light water reactors.

NEED FOR DOE TO CORRECT ITS ESTIMATES OF URANIUM RESOURCE REQUIREMENTS

Our April 10 letter to the Secretary of Energy was a by-product of an ongoing study on the future of nuclear power in the United States which is still underway. We pointed out that the Department of Energy has not been taking account of uranium losses that occur in the milling process when it assesses the adequacy of the U.S. uranium resource base to meet the expected demand for uranium.

We noted in the letter that historical data on U.S. uranium production shows a close relationship between the grade of uranium ore processed and the magnitude of mill losses. The grade of uranium ore processed has been declining, with a commensurate increase in milling losses. For example, the current average grade of U.S. uranium reserves is 0.07 percent, or about half that being used for current production. Taking this as a reasonable indication of the uranium ore grade which would be mined in the 1990s and beyond, and factoring in the observed relationship between mill loss and ore grade over the last 13 years, we calculated

that mill losses could reach 17 percent by the end of the century.

The significance of such increasing mill losses is that, when they are taken into account, the demand for uranium at the mine must be corrected upward. At present DOE estimates that a 1 gigawatt (1,000 megawatt) reactor would require about 5,500 tons of U_3O_8 over its 30-year lifetime. Correcting for 1977 mill losses would require raising this demand on the resource base to almost 6,000 tons, and correcting for the losses anticipated by the 1990s would raise the requirement to over 6,600 tons, 20 percent more than the current DOE estimate. Such a difference, we believe, could have an impact on estimates of the adequacy of the uranium resource base.

Let me emphasize that this computation of the effect of mill losses is a correction which should be applied to estimates of uranium demand, and is a completely separate matter from the uncertainties which are generally assigned to estimates of uranium reserves and resources.

We recommended that assessments of the adequacy of uranium resources be corrected for mill losses, both in the future and in past studies which may have influenced nuclear policies. I will return to this subject later. However, I would first like to discuss the uranium resource issue as it relates to decisions regarding the Clinch

River Breeder Reactor project.

UNCERTAINTIES OF URANIUM RESOURCE ESTIMATES AS THEY RELATE TO THE CLINCH RIVER BREEDER REACTOR DECISION

In April 1977, the Administration proposed a major redirection in U.S. nuclear energy policies which included delaying LMFBR development and terminating the Clinch River project. Spokesmen for the Administration have, on various occasions, presented three reasons for terminating the Clinch River project: (1) the risk of nuclear proliferation, (2) the technical obsolescence, small size, and large costs of the facility, and (3) recent Department of Energy estimates that the U.S. uranium resource base is sufficient to delay significantly the date by which breeder technology will be needed in the United States.

Our Clinch River report examines these justifications and other factors important to the question of whether the project should be terminated or completed. In summary, our examination showed that the weight of evidence available on the subject supports continuation of the Clinch River project if this Nation wishes to maintain a strong breeder reactor research and development program.

Our examination of the three issues of proliferation, technology, and uranium supply showed that:

--Termination of the Clinch River project would accomplish very little in the area of nuclear

nonproliferation. Other nations are continuing their breeder programs and are likely to proceed whatever the United States does. In a report comparing alternative nuclear technologies which we released last week, 1/ we concluded that there is no proliferation-proof reactor technology, but that a combination of approaches including institutional changes and steps such as colocation of fuel cycle facilities could reduce the risks of proliferation.

--There was little support for arguments regarding the technical obsolesence of the Clinch River design. We interviewed a broad range of persons in industry and Government, including Department of Energy and other Administration officials, and were unable to find support for this view. 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. The Administration has particularly questioned the wisdom of the choice of a loop rather than a pool

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1/Nuclear Reactor Options To Reduce The Risk Of Proliferation And To Succeed Current Light Water Reactor Technology (EMD-79-15; May 23, 1979).

design. We found an overwhelming consensus that neither design is clearly superior for safety, economic, or environmental reasons. Furthermore, in its February 1977 final environmental impact statement on the Clinch River project, the Nuclear Regulatory Commission concluded 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 uncertainties that surround uranium supply and nuclear power requirements over the next several decades do not support the Administration position that the uranium supply to fuel light water reactors will be sufficient to delay breeder introduction until about 2025. Let me expand on this point since it is particularly germane to today's hearing.

Many projections have been made of the amount of domestic uranium available. In 1978 DOE estimated that about 4.4 million tons of uranium probably were available for mining in this country, comprised of 0.9 million tons of proven reserves, and 3.5 million tons of other more speculative categories of resources. 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.

However, while most knowledgeable sources agree with DOE's proven reserves estimates, there are strong differences of opinion on the amount of possible and speculative resources that may be found. For instance, in 1978 a study group of 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 group stated that there is a 97 percent probability that U.S. uranium resources are less than a DOE 1977 estimate of 3.78 million tons, which is, in turn, lower than DOE's 1978 figure. 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 licensed for construction.

Aside from information developed by us on the three arguments advanced by the Administration against funding the Clinch River project, we also concluded that:

--the Clinch River project's intermediate size represented a logical and prudent step in breeder reactor development

--because the Clinch River project is subject to the licensing process, abandoning it for a larger plant to be built on a Government reservation and not subjected to the licensing process could lead

to adverse economic consequences and reduced public confidence in efforts to commercialize breeder technology

--abandoning the Clinch River project will make it difficult to maintain utility and supplier commitment to the breeder program.

Given these uncertainties and concerns, we concluded that, if this Nation wishes to maintain a strong LMFBR research and development program, the Clinch River project should be built. It is important to note that GAO has always maintained that building the Clinch River Reactor does not represent a decision to commercialize breeder technology. Rather, it is the next logical step in providing the information needed to make future decisions on the desirability of commercialization.

ANALYSIS OF THE DEPARTMENT OF ENERGY NUCLEAR STRATEGY PAPER

Since we issued our report, we have continued to analyze the issue of the adequacy of uranium resources. We have done this to test the effect which would arise from applying mill loss corrections to the analyses supporting the Administration's LMFBR policy, and also because DOE's response to the draft of our Clinch River report contended that we had not addressed on its merits their analysis of uranium reserves and resources as regards the need and timing for a breeder.

The DOE analysis is contained in a document, "The Nuclear Strategy Of The Department of Energy," which concludes that uranium resources are sufficient to allow substantial delay before the introduction of a first demonstration fast breeder reactor.

The DOE strategy paper calculates the dates when a first commercial breeder reactor would have to be introduced in each of a number of hypothetical future cases. The calculations are done by two different methods. One method is based on what is called a "finite ore" model. In this model the date is the year when all uranium resources would have been committed to existing non-breeder reactors, so that future reactors would have to be breeders. The other method is based on an economic model. In this model the date is the year when it would first became more economical to introduce a breeder reactor than another non-breeder. DOE concluded that its analysis showed that commercial breeders were probably not needed until after 2025.

We found that introducing the mill corrections made a significant, but not an overwhelming difference in the results of DOE's analysis. I can illustrate this best in my Exhibit I which refers to the results from

the "finite ore" model.* In this chart, the top bars show the percentage of the cases that DOE examined which would require a breeder before 2010, between 2010 and 2025, and after 2025, while the bottom bars show the percentages after corrections for conservatively estimated mill losses. As you can see, according to DOE 28 percent of the cases analyzed justify deferral of the breeder until after 2025. However, when mill losses are applied to the DOE calculations, only 12 percent of these cases justify deferral until after 2025. In fact, we found that including mill losses indicates that over one-half of the cases analyzed in the finite ore model require a commercial breeder before 2015. Using the DOE schedule for deliberate breeder development of 36 years, this would indicate a need for initiation of a first demonstration reactor this year.

More significant, in our view, is the result of reexamining the DOE analysis in light of the

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* This exhibit is based on results calculated by DOE assuming 0.2 percent tails left after enrichment, which is about the design limit of current gaseous diffusion technology and next generation centrifuge technology. DOE also presents calculations based on their prediction that advanced isotope separation (AIS) will make 0.05 percent tails possible in the 1990s. At this time, AIS is only in the research and development stage. We believe it prudent to focus on what we know is possible now.

uncertainty of uranium resource estimates. Briefly stated, we believe that long range planning should prudently be based on high-probability projections rather than on less probable or speculative ones. In that light, we looked again at the same dates which we corrected to take into account uranium milling losses.

We found that DOE, in its finite ore model, used three different estimates of uranium availability that can be assigned different probabilities. Every single case of the most probable set, and half of the cases in the intermediate probability set, would require immediate initiation of a breeder reactor development project and furthermore most of these cases require that the demonstration program be carried out on an accelerated schedule. I have illustrated this in our Exhibit II, in which the three blocks represent the three sets of cases, going from most probable on the left to least probable on the right. The red coloring is put in to indicate what portion of each set requires prompt initiation or acceleration of a breeder demonstration project. As you can see, all of the most probable cases are colored, as are half of the intermediate probability cases. Only the least probable set, corresponding to the highest resource estimate, shows a predominance of cases which allow delay of a breeder demonstration. In other words, while our analysis concludes that slightly more than

half of the DOE cases would require the prompt initiation of a breeder demonstration project--our estimate is 58 cases out of 108--this is only part of the story. More important, in our view, is that all of the cases under which a breeder demonstration project could be postponed are based on resource estimates with only medium to lower probabilities.

The economic model in DOE's strategy paper was not presented in sufficient detail to permit us to analyze its results as completely as we did the results of the finite ore model. However, there are two major areas of assumption in the model which bear close examination. One is the range of estimates used of the relative capital costs of LMFBRs compared to light water reactors, and the other is, again, the size of the U.S. uranium resource base.

The uranium resource estimates in the DOE economic model are not limited, as in the finite ore model, but increase without constraint as the price rises, as is common in economic analyses. The result of this approach is that most of the cases which DOE finds allow delay of a first breeder until after 2025 correspond to the U.S. having more uranium available than is treated in any of the three resource estimates in the finite ore model. To summarize, my basic point in presenting this additional analysis today is to further underline the assumptions and

uncertainties which are involved in any estimate of uranium reserves and resources.

CONCLUSION

Before concluding my statement, Mr. Chairman, let me stress that our conclusion about the need for the Congress to continue funding the Clinch River project is premised on the assumption that the Nation wants to continue a strong LMFBR research and development program. Beyond that assumption, there are two other matters which the Congress must factor into any decision on the future of the Clinch River project.

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 commits to 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 project. 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.

Mr. Chairman, this concludes my testimony. I would be pleased to respond to your questions.

EXHIBIT I

CORRECTION FOR URANIUM MILLING LOSSES
APPLIED TO
DOE's ANALYSIS OF BREEDER TIMING

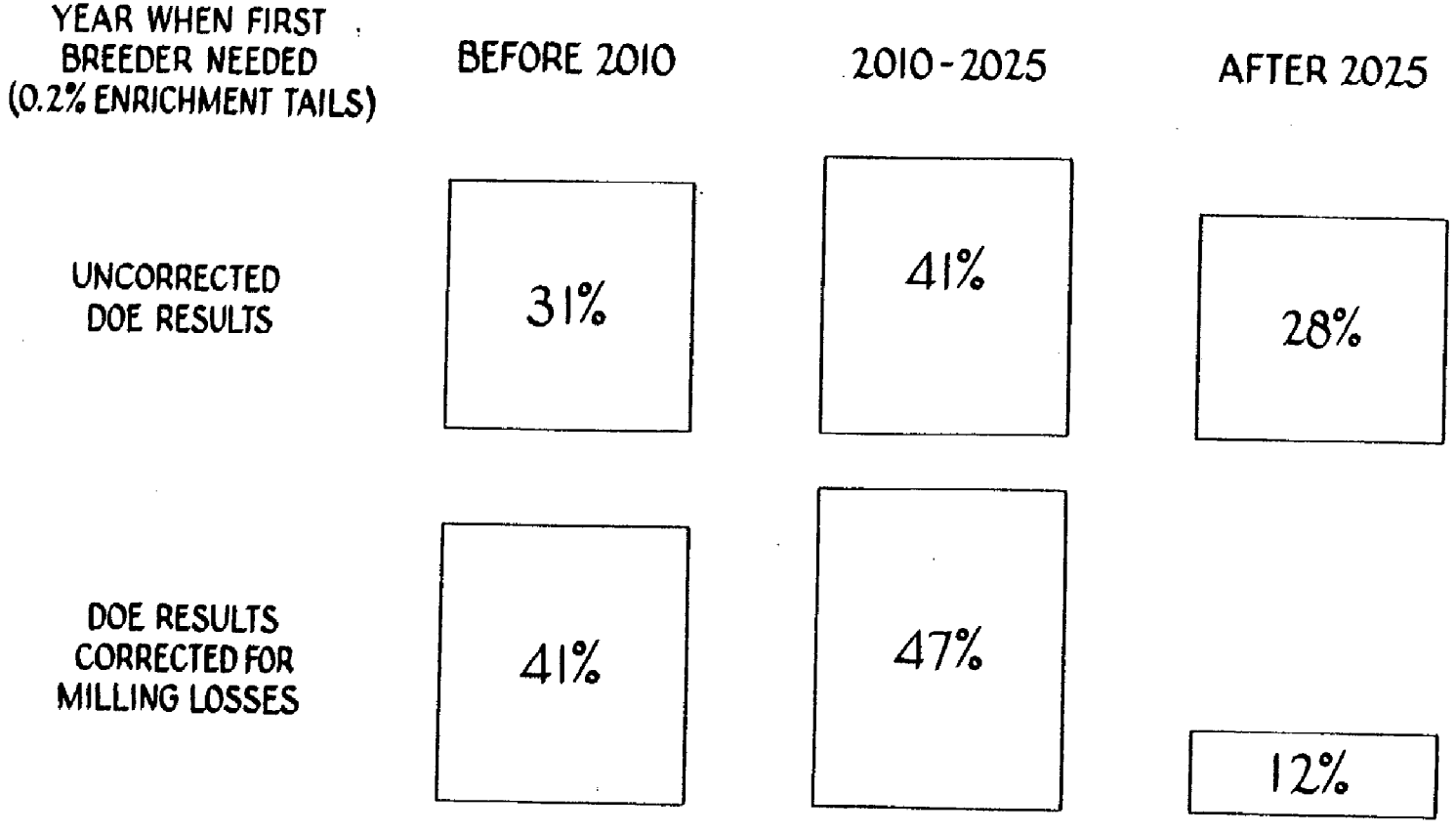
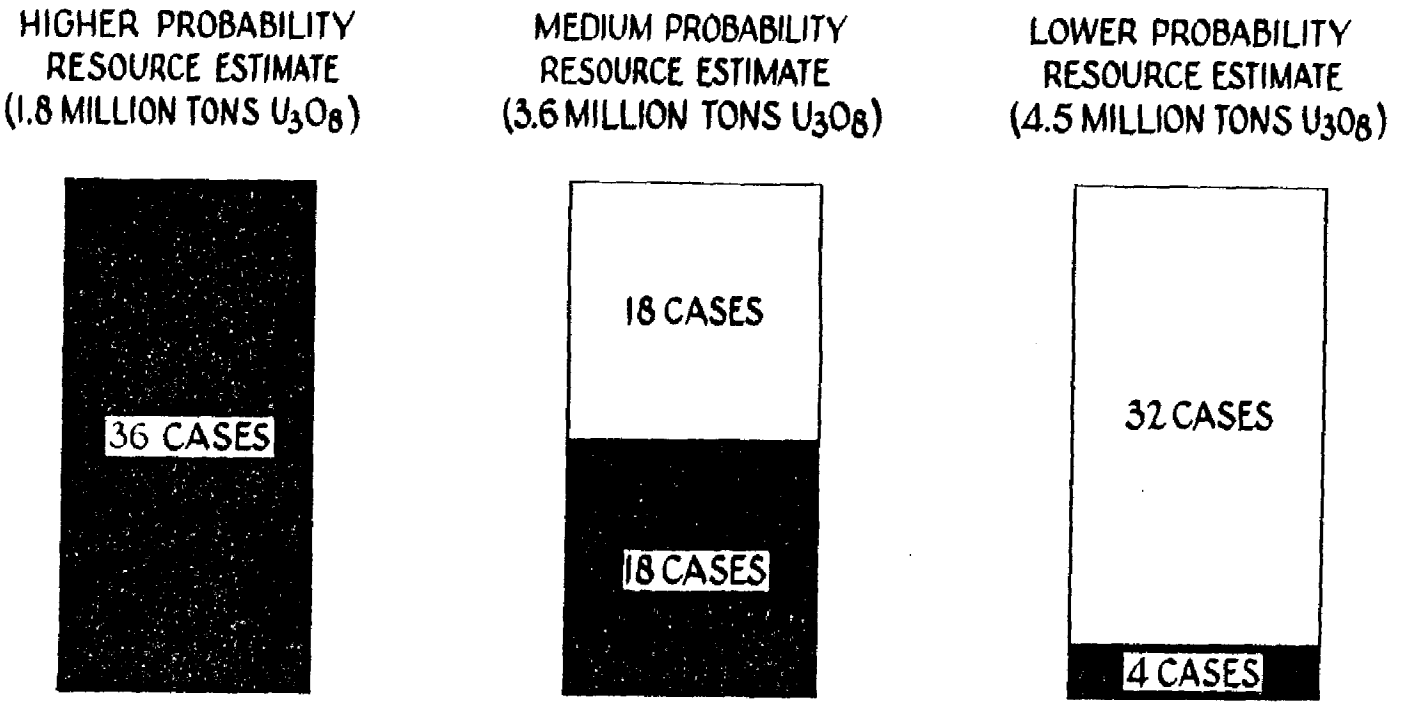


EXHIBIT II

GAO REANALYSIS OF TRANSITION DATES TO A BREEDER REACTOR

(DOE "FINITE ORE" MODEL, 0.2% ENRICHMENT TAILS)



COLORED AREA SHOWS CASES REQUIRING PROMPT INITIATION OF BREEDER DEMONSTRATION PROJECT
(FIRST COMMERCIAL BREEDER REQUIRED BY 2015)