50-537

LIQUID METAL FAST BREEDER REACTOR PROGRAM

RECORD OF DECISION

This Record of Decision has been prepared as required by the Council on Environmental Quality regulations (40 CFR 1500 et seq.) implementing the National Environmental Policy Act (NEPA).

Decision

On June 9, 1982, the United States Department of Energy (DOE) released a Final Supplemental Environmental Impact Statement (FEIS) for the LMFBR Program (DOE/EIS-0085-FS, May, 1982). This document supplements an earlier Environmental Impact Statement for the Liquid Metal Fast Breeder Reactor (LMFBR) Program (ERDA-1535, December, 1975). Having reviewed these documents and other current information pertinent to the LMFBR Program, DOE affirms that the currently planned LMFBR Program as described in the FEIS, including construction of the Clinch River Breeder Reactor Plant as soon as possible, should continue to be pursued.

The LMFBR Program

The goal of the breeder program is to ensure that a proven long-term electricity supply option is available on a prudent time scale. To accomplish this goal the U.S. LMFBR program was established with the overall objective of developing the technical, engineering, safety, environmental, economic, licensing, and industrial data base that will be required for the design, construction, and operation of future LMFBR powerplants on a utility grid. The program consists of three broad elements that are essential to meeting this goal; (1) construction and operation of developmental plants (e.g., the

D503

Clinch River Breeder Reactor Plant), (2) a supporting base technology program including test facilities, and (3) supporting fuel cycle programs.

Description of Alternatives

Three classes of alternatives to the currently planned program were considered:

1) Alternatives within LMFBR Program. Three alternatives within the LMFBR Program were considered:

(a) Termination of the Clinch River Breeder Reactor Plant (CRBRP) and proceeding directly to the Large Developmental Plant (LDP) project.

(b) Completion of the CRBRP as the last developmental plant of the overall program (i.e., no LDP).

(c) Termination of both developmental plant projects.

The gains from each of these three alternatives would be the financial savings from eliminating the construction cost of each respective plant, as well as avoiding the environmental impacts associated with construction and operation.

If the CRBRP Project is terminated, the base for scale-up of LMFBR technology from small plants to near-commercial size would be limited to results of the base technology program and the operational experience of the EBR-II and the Fast Flux Test Facility (FFTF). The potential for intermediate size plant data on licensing, startup, operation, individual component performance, overall plant performance, reliability, environmental impacts, and maintainability of an LMFBR in a commercial utility environment, would be lost. As a consequence, the risk that the LDP would have major technical problems would

be significantly increased. Early utility participation in LMFBR construction and operation would also be lost, with attendant erosion of utility confidence in the LMFBR program. Termination of CRBRP would thereby jeopardize the goal of the LMFBR program for supplying the nation with an important long-term energy option.

If the LDP is not built, the capability for commercial deployment of LMFBRs may be indefinitely delayed. The implication of this action would be that the economic and technological base needed to establish the viability of the breeder for commercial application by the nuclear industry would be incomplete. The CRBRP alone cannot generate a sufficient base of safety, construction, environmental impact and operating data to permit a sound commercialization decision by utilities. Also, this alternative will probably result in significant erosion of the industry/utility/laboratory infrastructure that will form the basis for future LMFBR commercialization. Truncation of the LMFBR program after CRBRP would jeopardize the potential for meeting the LMFBR program goal.

The cancellation or deferral of both developmental plants, with continuation of only a generic base R&D program, would lead to an indefinite delay in any potential deployment date for LMFBRs because licensing and plant operating experience would never be obtained. Even the remaining base program would lose focus without specific plant projects on which to concentrate its efforts. Many of the opportunities for the involvement of utilities and reactor manufacturers would be lost also.

Although it is clear that selection of any one of these three alternatives would result in less short term environmental impacts, the structure of the currently planned program is such that information critical to environmental concerns would be obtained in a timely manner as the program progresses and would likely result in informed program decisions to lessen any environmental impacts.

2) No Action. In this alternative, the entire LMFBR program would be terminated. Such a termination would mean turning away from 35 years of progress in developing a technology which has an excellent potential for supplying a substantial amount of energy in the next century. Technological feasibility is proven and no fundamental scientific breakthroughs are required for further engineering development and eventual deployment. Termination of the LMFBR Program would result in the loss of the existing pool of experienced technical specialists and in the loss of specialized R&D facilities. Failure to develop the LMFBR as a long-term electricity supply option could have serious consequences for the nation should other long-term options fail to develop adequately. Thus the no-action alternative appears to be unacceptable.

3) Alternative Long-Term Technologies. These essentially inexhaustible technologies are various types of fusion power plants (magnetic and inertial) and solar electric systems (wind energy conversion, solar photovoltaic conversion, solar thermal conversion, and ocean thermal energy conversion). The goals and accomplishments of the DOE programs to develop these technologies were addressed in the Supplemental EIS. Until these alternative long-term technologies meet their development goals, it is not possible to determine

their relative competitiveness with the LMFBR. In addition, impacts of these long term technologies aren't sufficiently well known to permit a meaningful selection of which one(s) to pursue for environmental reasons.

Basis for Decision

The United States needs to develop energy options which can provide substantial amounts of energy over the long term. Energy sources will be needed to replace the increasingly scarce supplies of oil and gas which currently supply 70 percent of the nation's energy needs. Electrical energy is expected to continue to supply an increasing share of the growing U.S. energy demand. Energy growth potential and the need for oil and gas substitutions provide the motivation for developing long-range, essentially inexhaustible electrical energy sources such as the LMFBR.

Research and development activities on promising long-term options, such as the LMFBR, fusion, and solar electricity technologies, are required to meet future U.S. energy needs. Because of the relatively advanced state of LMFBR technology, it is the surest of the large scale, inexhaustible supply options. If fusion, solar electricity, and the LMFBR development programs were all successful, the contributions of each would depend on their economics, among other important factors. Because today the LMFBR is presently in the most advanced stage of development, it provides the insurance against failure of the other long-term alternatives to develop in a timely way, and against the failure of coal to meet expectations.

The LMFBR is a complex undertaking that still requires years of intensive work before its technology is developed to a point of acceptable commercial

risk. Technological feasibility has been demonstrated in a number of small and intermediate size LMFBRs built and operated in the U.S. and abroad. Future LMFBR progress will rely on the successful development of near commercial scale engineered systems rather than on significant technological breakthroughs.

A draft environmental statement for the U.S. Liquid Metal Fast Breeder Reactor (LMFBR) program was first issued by the Atomic Energy Commission (AEC) in March 1974 for review and comment by interested parties. The AEC issued a Proposed Final Environmental Statement (or PFES, designated WASH-1535) in January 1975, providing the newly created Energy Research and Development Administration (ERDA) the opportunity to review the LMFBR Program before issuing a final statement. The ERDA Administrator found that the PFES amply demonstrated the need to continue research, development, and demonstration of the LMFBR and that significant problems, including, in particular, those related to reactor safety, safeguards, health effects, and waste management were unresolved at that time. Subsequently, the Final Environmental Statement (FES) was prepared and issued as ERDA-1535 in December 1975, incorporating the PFES by reference.

In the ERDA Administrator's findings on the PFES, issued on June 30, 1975, it was noted:

> "...as the program develops and significant new information pertinent to the commercial deployment issue is generated, ERDA will update the existing Environmental Statement or prepare a Supplement to it...as may be appropriate and consistent with the National Environmental Policy Act."

The LMFBR program described in ERDA-1535 contemplated gradual scale-up of demonstration facilities with government participation both in early commercial breeders and ultimately in making a decision with respect to the acceptability of widespread commercial deployment of LMFBR technology. There have been changes to the emphasis of this program, the most important of which is that the decision on deployment and commercialization of the LMFBR will be made by the utility industry. The government role will be limited to early development of the technical, engineering and industrial base needed to lower risks and uncertainties to levels consistent with normal commercial ventures and to demonstrate the safety, environmental acceptability and economic potential of LMFBRs.

The reduced scope of the program and the environmental impacts associated therewith were examined in the Supplemental EIS. This included a re-examination of the purpose and need and timing of the program, the present program structure, including reasonable program alternatives, and alternative electricity production technologies anticipated to be available within the same timeframe as the LMFBR.

New information pertinent to the environmental issues associated with the program, such as LMFBR safety, safeguards, waste management, and health effects, was documented. Except as they are examined in the Supplemental EIS, the evaluations contained in ERDA-1535 of the environmental impacts associated with commercial deployment of the LMFBR technology are still considered valid by DOE. No significant new information relevant to environmental concerns and bearing on the proposed action or its impacts was identified during this most recent review.

In the period since WASH-1535 was issued, there have been no new safety issues identified which would prevent the design, construction, and operation of safe and licenseable LMFBRs. The safety research and development program continues to build upon the comprehensive base of safety-related information (as described in the PFES and FES) aimed at providing realistically conservative LMFBR powerplant designs and resolving safety issues so as to assure the breeder's acceptability to regulatory authorities, industry, and the public. Substantial progress toward the resolution of key safety questions has been made. All this strengthens the ERDA-1535 conclusion that the conservative approach provides a satisfactory basis for proceeding with LMFBR projects, even though safety R&D is not yet complete.

Existing safeguards capabilities are designed to deter, detect, respond to and interdict adversary actions. These capabilities have been improved over the last six years (since ERDA-1535 was issued) to assure increased effectiveness and to further reduce risks associated with adversary actions. Improvements have been developed to assure that all elements of the LMFBR fuel cycle will be adequately protected. The extensive safeguards R&D program, the experience gained in the past, and being gained from implementation of safeguards in new facilities under construction, serve to confirm the effectiveness of the safeguards measures which are available for application to the commercial LMFBR industry. The DOE continues to support the previously stated conclusion that there is no safeguards-related reason to delay the further development of the LMFBR.

Over the past 35 years management techniques have been developed and refined to safely store and control radioactive wastes. Low-level waste is effectively disposed of in shallow land burial sites at government and commercial facilities. Spent fuel from commercial reactors is stored at reactor sites and at facilities in Morris, Illinois and West Valley, New York. High-level waste has been stored in steel tanks since the advent of nuclear energy. Work is continuing to develop and operate facilities for the isolation of high-level waste from man's environment in geologic repositories. The base technology is in hand now for the development of such geologic repositories, but careful examination of candidate sites must be completed before a choice is made for the first repository. The major waste management issue has been selection of a generally accepted method for removing and segregating high-level and transuranic radioactive wastes from man's environment for the long time periods required for these wastes to decay to safe levels. The problem of waste disposal is not unique to the LMFBR fuel cycle, but also must be resolved for the LWR or other nuclear fuel cycles and for the wastes resulting from defense programs. Furthermore, the quantities of LMFBR high-level and transuranic wastes will be considerably smaller than the quantities of such wastes from the LWR fuel cycle or from defense programs until well into the twenty-first century. There is general agreement among the technical community, government agencies, elected leaders, and the public that mined geologic disposal is the preferred disposal method for high-level and transuranic wastes. DOE carefully considered the environmental impacts and concluded that mined geologic disposal was preferred at this time above all other methods.*

*See DOE/EIS-0046F, Final Environmental Impact Statement: Management of Commercially Generated Radioactive Waste, U.S. Department of Energy, October 1980, and Record of Decision, 46 FR 26677, May 14, 1981.

With respect to health effects, a release of 0.36 mCi of alpha-emitting transuranic elements per 1000 MWe-year is estimated to occur as a result of normal operations of the LMFBR fuel cycle. Accidents are predicted to contribute insignificantly to total releases because of the low probabilities associated with accidents. The total release is assumed to be in the form of airborne particulates. Deposition of these particulates in man is assumed to occur as a result of direct inhalation of the airborne release, inhalation of material resuspended after initial deposition on the ground and ingestion of material incorporated in or on foods. Deposition in man is estimated according to conservative models, for periods of time extending for the lifetime of the radioactive materials. Absorption of the transuranics by man, and their distribution and retention within man, are assumed to follow models prescribed by the International Commission on Radiological Protection (ICRP) except for one major exception, where substantially higher estimates for absorption of ingested transuranics are employed. ICRP procedures are also employed in the calculation of radiation doses to various human organs and tissues. It is estimated that there would be about 0.0012 cancer deaths and 0.0006 serious genetic effects per year of model LMFBR operation. These effects are so small that they would be indistinguishable from other causes of cancer deaths or genetic effects in the U.S. population (there are about 107,000 genetic effects per million live births in the United States and about 167,000 cancer deaths normally expected during the lifetime of one million individuals in the United States).

Solar electric and fusion were the two technologies singled out in ERDA-1535 as major candidates, in addition to the breeder, to provide an essentially

inexhaustible source of energy to help meet the Nation's electrical energy needs in the next century. These are still the primary candidates for meeting long-term U.S. energy needs. Government policy is that public spending is appropriate in long-term energy research, where the risks and potential payoffs are high. The LMFBR, solar electric, and fusion programs are all being pursued. All three technologies may be needed in the twenty-first century. There is no need to choose among these three long-term alternative energy technologies now. The marketplace will make selections based on environmental, economic, regulatory and other grounds, when the technologies are developed. The Government strategy is, and has been, to pursue a broad program of research and development, to ensure that these technologies can be deployed when they are needed.

Discussion of Environmentally Preferable Alternative(s)

Based on the information available at this time, the Department concludes that it is not possible to determine whether any of the alternatives are environmentally preferable to the current LMFBR Program. Alternatives within the program would have smaller environmental impacts in the short-term, but would not provide important environmental information needed to avoid or mitigate environmental effects and would likely have greater associated economic and technical risks. The no-action alternative appears to be unacceptable from a long-term energy perspective. Alternative long-term technologies are not sufficiently developed yet to enable a choice to be made, on environmental, technological, or economic grounds, as to which one(s) to pursue. In addition, there is no environmental reason not to pursue the LMFBR at this time.

Mitigation

The Department will continue to evaluate the environmental impacts associated with LMFBR Program facilities and activities and will take additional measures to mitigate environmental impacts as needed.

Conclusions

The Department has considered the environmental costs and benefits associated with the LMFBR Program and reasonable alternatives and concluded not only that the present LMFBR Program should continue to be pursued expeditiously but also that efforts to reduce uncertainties associated with LMFBR safety, safeguards, waste management, and health effects should be continued as well. Although there have been changes in the LMFBR program since 1975, it is concluded that there is no significant new information relevant to environmental concerns, developed since ERDA-1535 was completed, and that the changes in the currently planned program from the program analyzed in ERDA-1535 do not represent substantial changes relevant to environmental concerns. Therefore, the LMFBR Program should proceed expeditiously. The CRBRP is a key element of the LMFBR program and is needed as soon as possible.

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(Date)

for Thomas O. Willcox
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