1 NEED FOR RESUMPTION OF L-REACTOR OPERATIONS AND PURPOSE OF THIS ENVIRONMENTAL IMPACT STATEMENT

The U.S. Department of Energy (DOE) operates two nuclear reactor production complexes for the purpose of producing plutonium and tritium for the nation's defense programs; these complexes are the Savannah River Plant (SRP) in South Carolina and the Hanford Reservation in Washington State. Three SRP reactors (C, K, and P) are presently operating; they produce the majority of the plutonium and all the tritium used for defense programs. At Hanford, one production reactor, the N-Reactor, is being operated in a combined mode to produce plutonium for defense programs and steam for electric power generation.

Current forecasts of nuclear material needs for defense programs indicate that these existing production complexes have insufficient capacity to meet projected plutonium requirements. To prevent shortages, especially during the next few years, DOE proposes to resume operation of L-Reactor at the Savannah River Plant as soon as practicable. This proposed action is one of a series of production initiatives being taken to increase the supply of weapons-grade plutonium to a level that will satisfy the projected requirements.

1.1 NEED

1.1.1 Defense nuclear materials

The responsibilities of DOE in the area of defense programs stem from the Atomic Energy Act of 1954, as amended. This legislation establishes the Department's responsibility to develop and maintain a capability to produce all nuclear materials required for the defense programs of the United States.

In 1980, a high-level Policy Review Committee (members included the Secretaries of State, Energy, and Defense), under the auspices of the National Security Council, was convened to assess changes needed in the nation's nuclear weapons stockpile. The committee determined that the stockpile should be increased and that additional nuclear material production capacity will be required to meet the increased requirements. Also, the committee determined that a number of new production initiatives should be started at that time. The increased requirements were defined in the fiscal year (FY) 1981-1983 Nuclear Weapons Stockpile Memorandum (NWSM), approved by President Carter on October 24, 1980.

The Nuclear Weapons Stockpile Memorandum is the document by which the President annually authorizes the production and retirement of nuclear weapons. In the memorandum, the Secretaries of Defense and Energy jointly recommend to the President the size and composition of the nuclear weapons stockpile they believe is required to defend the United States. In the development of this memorandum many factors are considered, such as the needs of the armed services; the current status of legislative actions concerning weapons systems and production capability; and the current status of material inventory, material supply BL-19,
from weapon retirements, material production and weapons fabrication. Included BL-21, BY-2

in the memorandum to the President is the plan for producing the nuclear materials required to support the nuclear weapons stockpile. The Nuclear Weapons Stockpile Memorandum is forwarded to the President through the National Security Council. In accordance with the Atomic Energy Act, approval of the NWSM by the President and subsequent authorization and appropriation of funds by the Congress constitute the legal authority and mandate to DOE to produce the specified types and quantities of nuclear materials and weapons. If significant changes occur after the development of an NWSM, such as Congressional action that poten- BL-19, tially affects material supply and demand, DOE factors the impact into its EN-5 implementation of the NWSM requirements after the Department of Defense formalizes the modified requirements.

The increased requirements authorized in the FY 1981-1983 Nuclear Weapons Stockpile Memorandum resulted from efforts to modernize and improve stockpiled nuclear weapons, as well as to provide warheads for new weapons systems scheduled for deployment during the next decade. The program to modernize existing weapons systems involves replacing older nuclear warheads and existing delivery systems with modern, safer, and more effective warheads. Modernization, in many instances, has led to replacing older warheads that used uranium enriched in the isotope uranium-235 with new warheads that use weapons-grade plutonium.

The increased defense nuclear material requirements and the production initiatives necessary to provide the resultant additional production capacity have been reaffirmed in subsequent Stockpile Memoranda since 1980, including the FY 1984-1989 NWSM. Congress has generally supported, through authorization legislation and appropriation of funds, the initiatives necessary to produce the needed additional nuclear materials.

The current nuclear materials requirements for defense programs come from the FY 1984-1989 NWSM, approved by President Reagan on February 16, 1984. This document defines the annual requirements for defense nuclear materials for the first 5 years (FY 1984-1989), the planning directives for the next 5-year period, and 5 additional years of projections for long-range planning. In his approval of the FY 1984-1989 Nuclear Weapons Stockpile Memorandum, Presi- BL-19, dent Reagan emphasized the importance of meeting these annual requirements BL-21, and maintaining an adequate supply of defense nuclear materials by directing EN-1 that: ". . . as a matter of policy, national security requirements shall be the limiting factor in the nuclear force structure. Arbitrary constraints on nuclear material availability . . . shall not be allowed to jeopardize attainment of the forces required to assure our defense and maintain deterrence. Accordingly, DOE shall . . . assure the capability to meet current and projected needs for nuclear materials and . . . restart the L-Reactor at the Savannah River Plant, Aiken, S.C., as soon as possible."

During the fall of 1983, the Departments of Energy and Defense developed the FY 1984-1989 NWSM. This NWSM incorporated the changes in proposed weapon systems that had occurred since the FY 1983-1988 NWSM was prepared, as well as BL-19, the modified material inventory requirements and material supply from weapon re- BY-2, tirements. Changes have affected the required delivery of defense nuclear ma- EN-5 terials, because Congress has delayed or did not fund certain nuclear weapons systems mentioned in the FY 1983-1988 NWSM; however, the production capacity of the implemented and proposed initiatives is still needed to meet the requirements of the FY 1984-1989 NWSM.

Certain events that have occurred since the development of the FY 1984-1989 NWSM have the potential of affecting the supply and demand for defense nuclear materials; these include the Congressional action to delete DOE funding for production facilities for the warhead for the 155-mm artillery-fired atomic projectile (AFAP). This warhead (W82) was intended to replace the W48 warhead, which is currently scheduled for retirement. The impact of the Congressional action on the need for material has not yet been determined; however, its effect and that of any other subsequent events will be factored into the implementation of the FY 1984-1989 NWSM when DOD requirements are revised to reflect Congressional actions. Because the Department of Defense has indicated that the retirement schedule for the W48 warhead will depend on the deployment of the W82, the Congressional action on the W82 warhead is not anticipated to result in a major impact on the need for the restart of L-Reactor. BL-19, EN-5

1.1.2 Need for L-Reactor

When the call for additional nuclear material was made by the National Security Council in 1980, there was insufficient operating capacity in the existing DOE production complexes to meet the increased requirements for both tritium and weapons-grade plutonium.* As a consequence, all identifiable production options were evaluated and the most timely and cost-effective options were implemented. These implemented initiatives included

- Altering the Hanford N-Reactor operating cycle to produce weapons-grade plutonium rather than fuel-grade plutonium.
- Restarting the PUREX Separations Plant at Hanford to recover the plutonium from the spent N-Reactor fuel in storage (primarily of high Pu-240 content) and the fresh spent fuel (6-percent Pu-240). The stored N-Reactor spent fuel is being sorted such that spent fuel with lower Pu-240 content can be processed first.
- Shortening the SRP reactor operating cycles to produce 3-percent Pu-240 assay plutonium rather than 6-percent Pu-240.
- Blending higher assay Pu-240 plutonium either from DOE-owned plutonium presently in inventory or from plutonium to be recovered from the operation of the Hanford PUREX Plant with the 3-percent Pu-240 plutonium being recovered at SRP to produce weapons-grade plutonium. BL-19

*Weapons-grade plutonium is primarily Pu-239 and contains less than 6-percent Pu-240. The term "fuel-grade" plutonium is used to refer to plutonium containing greater than 6-percent Pu-240, generally 9- to 14-percent Pu-240.

Figure 1-1 shows current operations and implemented initiatives; the implemented initiatives are described below.

The N-Reactor at the Hanford Reservation in Richland, Washington, operated strictly as a plutonium production reactor from its startup in December 1962 until April 1966. Since April 1966, the byproduct steam from N-Reactor has been used to produce electrical power in the adjacent steam plant belonging to the Washington Public Power Supply System. Before 1973, N-Reactor was operated part of the time to produce 9-percent Pu-240; the rest of the time, it produced weapons-grade plutonium (6-percent Pu-240).

From 1973 to 1982, N-Reactor produced plutonium with a Pu-240 content of approximately 12 percent. In 1982, it was switched from the production of fuel-grade to the production of weapons-grade plutonium. This conversion was to 6-percent Pu-240. In the 6-percent Pu-240 production mode, the schedule requires the shutdown and discharge of approximately one-fourth of the core eight times a year (rather than only four times a year for the 12-percent Pu-240 production program). Therefore, the fuel throughput increased by a factor of two, which required operational changes in fuel fabrication, reactor charge and discharge operations, the storage of spent fuel, and reprocessing.

The PUREX Separations Plant at Hanford is a large, remotely operated and maintained nuclear fuel reprocessing plant. It contains equipment for chemically dissolving nuclear fuel, recovering uranium and plutonium from solution by the PUREX solvent extraction process, and converting the chemically purified plutonium to solid plutonium oxide for shipment. Uranium is recovered as a concentrated nitrate solution, which is converted to an oxide powder in the Hanford
BL-21 uranium oxide plant; liquid wastes are neutralized and stored in tanks.

The PUREX Separations Plant operated from 1956 to 1972, when it was placed on standby. The resumption of PUREX Plant operations was authorized and funded in FY 1981. At that time, the predicted date for the PUREX Plant to resume operation was April 1984; however, the plant was restarted 5 months ahead of schedule. The PUREX Plant itself does not produce plutonium; it separates reactor-produced plutonium from uranium and waste products. The operation of this plant will maximize the amount of weapons-grade plutonium available for defense programs by processing the lower Pu-240 material first.

The early restart of the PUREX Plant will have a minor effect on the supply of weapons-grade plutonium during the timeframe of concern for L-Reactor, because sufficient supplies of fuel-grade plutonium are available in inventory for blending; in addition, the capacity of the PUREX facility is large in comparison with the backlog of N-Reactor weapons-grade material available for processing. Furthermore, the early plant restart was factored into the material supply information in the FY 1984-1989 NWSM approved by President Reagan on February 16, 1984.

Environmental effects for resuming operation of the PUREX Plant are discussed in the Final Environmental Impact Statement for PUREX Operation (DOE/EIS-0089).

Initially, most of the material the PUREX plant will recover will be a high-assay Pu-240 (greater than 6-percent) product. The recovery rate will exceed the availability of 3-percent Pu-240 produced at SRP for blending.

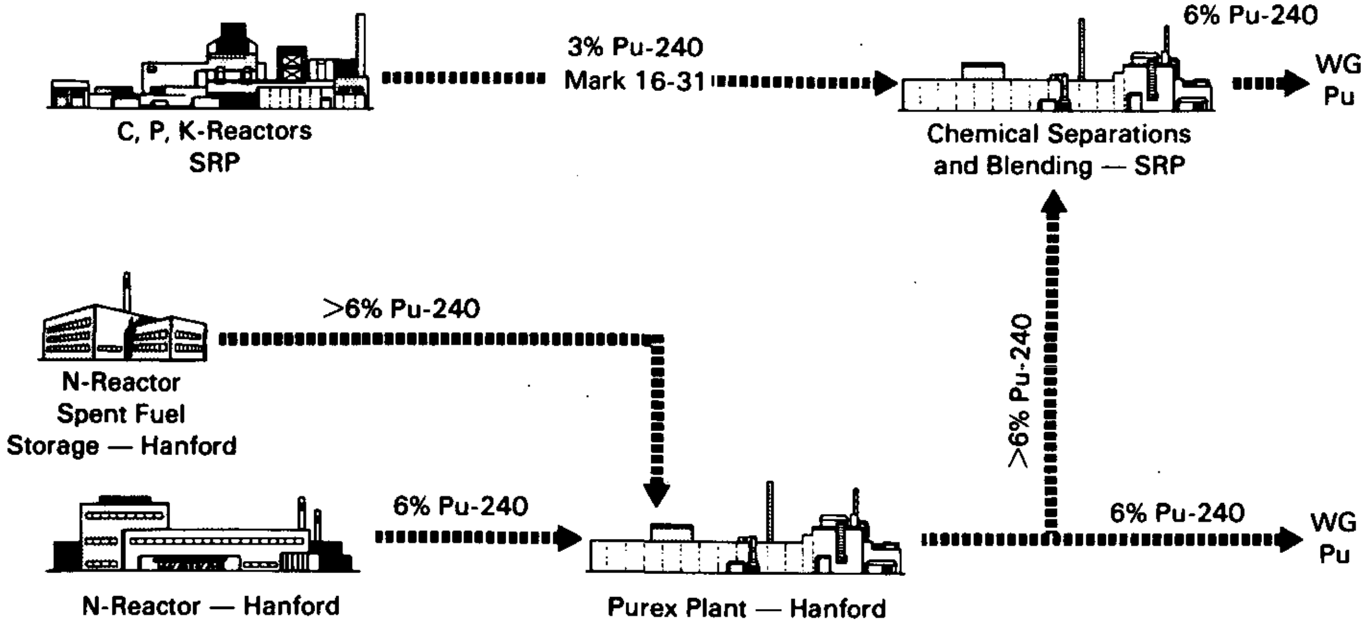

Figure 1-1. Current and implemented initiatives to produce weapons-grade (WG) plutonium (Pu).

Although PUREX will not always operate at full capacity during the 1980s, the available extra capacity cannot be put to any other practical use. The proposed operation of L-Reactor would accelerate the use of high-assay Pu-240 processed at PUREX because L-Reactor would produce additional 3-percent Pu-240 material for blending.

Spent fuel from N-Reactor has been accumulating in Hanford storage basins since the shutdown of the PUREX Separations Plant in 1972; this spent fuel is being reprocessed by the PUREX Plant. Although the N-Reactor has been operating with a nominal 12-percent Pu-240 content in its discharged fuel, the actual Pu-240 content varies from about 5 percent to 19 percent, depending on the fuel position within the reactor and its actual exposure. Physically sorting the fuel into batches (which started in 1983) before reprocessing allows the 6-percent Pu-240 assay fuel to be reprocessed first, thus making it available for early processing in the PUREX Plant. This plutonium is not a net gain to the system, however, because the remaining fuel-grade material produced from the
BL-21 PUREX Plant is blended at a slower rate due to its higher Pu-240 content.

Blending involves the conversion of fuel-grade plutonium to weapons-grade plutonium; this conversion occurs by mixing plutonium with less than 6-percent Pu-240 with plutonium containing greater than 6-1/2-percent Pu-240. One of the production initiatives undertaken in 1981 was to convert the SRP reactors to the production of 3-percent Pu-240. The major sources of high-assay Pu-240 for blending are spent fuel from N-Reactor and other DOE fuels containing plutonium originally processed at Hanford. The blending program was initiated with the use of existing inventories of fuel-grade plutonium.

The blending operation at SRP provides about a 50-percent increase in the amount of available weapons-grade plutonium, based on a nominal 12-percent Pu-240 content in existing spent fuel. Specific annual production rates of low-assay Pu-240 plutonium vary because tritium demand is satisfied before plutonium production at SRP, and tritium demand varies from year to year.

These implemented initiatives produce a substantially greater amount of plutonium, but not enough to fully meet the nuclear defense material requirements. To provide more plutonium production, DOE has proposed several additional initiatives for implementation; these proposed initiatives, shown in Figure 1-2, are to:

- Restart the restored L-Reactor at the Savannah River Plant.

- Use an improved fuel lattice (Mark 15) in the SRP reactors to produce significantly more plutonium than the present Mark 16-31 plutonium-producing lattice.

- Construct a special isotope separations (SIS) plant to process and convert fuel-grade plutonium into weapons-grade plutonium.

The Mark-15 homogeneous lattice has been designed to be the most efficient plutonium core that can be accommodated at SRP. It consists of a uniform re-
BL-21 actor lattice using slightly enriched uranium fuel (the Mark 16-31 plutonium-producing lattice currently employed at SRP uses highly enriched and depleted

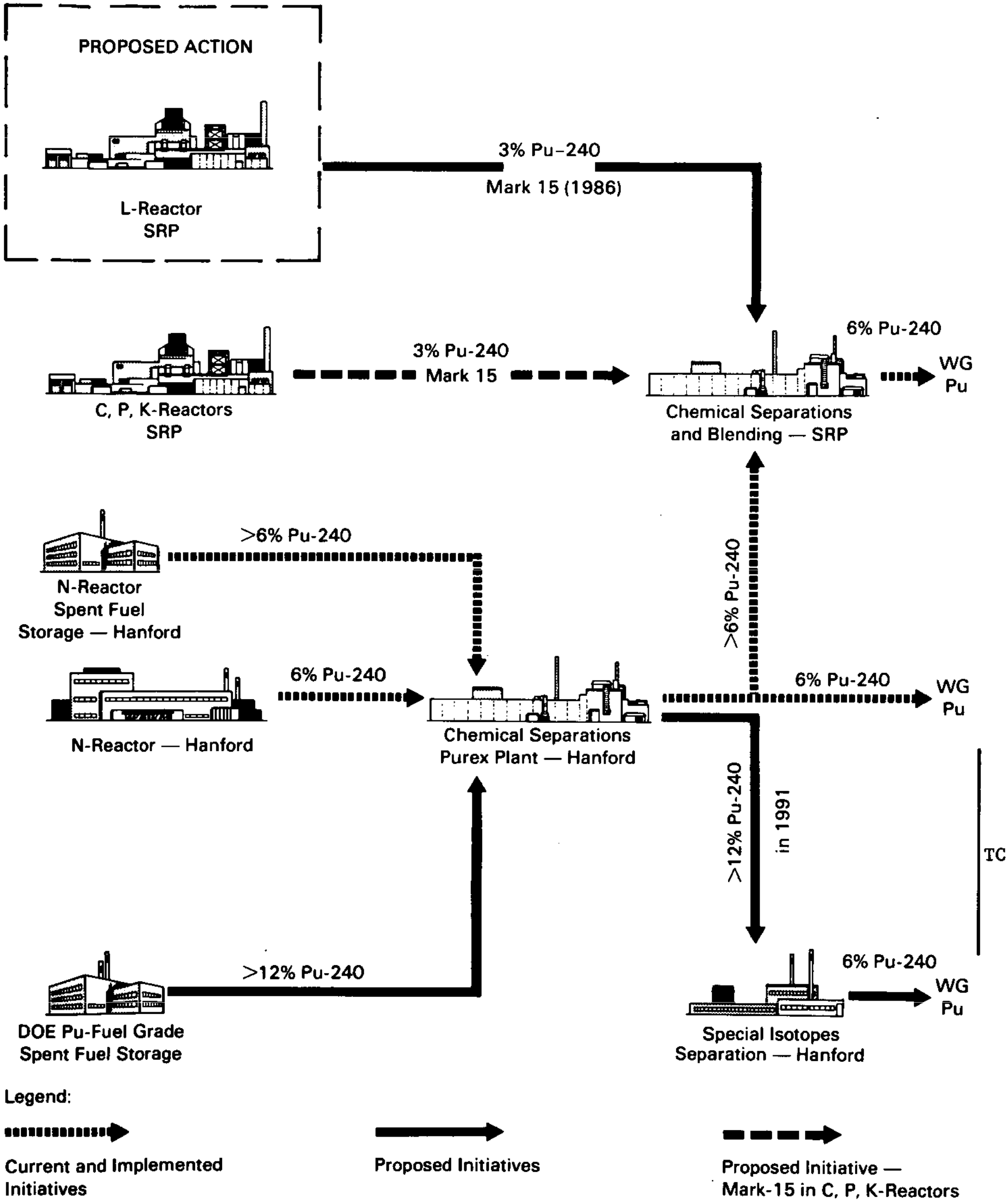

Figure 1-2. Current, implemented and proposed initiatives to produce weapons-grade (WG) plutonium (Pu).

BL-21 uranium elements). A demonstration Mark 15 lattice was operated successfully in the K-Reactor at SRP in August 1983. Implementation of the Mark 15 lattice is planned for late 1986.

Since 1972, the N-Reactor at Hanford has produced fuel-grade plutonium of high-assay Pu-240 for use in reactor studies and other DOE programs. Also, DOE has other fuel-grade plutonium stocks [e.g., Fast Flux Test Facility (FFTF)] that can be processed and fuel-grade plutonium that can be recovered in the PUREX Plant. Processing some of these spent fuels will require a shear-leach head-end addition to the PUREX Plant.

CX-4 The Department of Energy is currently proceeding with the development of the special isotope separation (SIS) process as a method to convert fuel-grade plutonium into weapons-grade plutonium. This process has been demonstrated only in the laboratory. The FY 1984-1989 NWSM is based on a scale-up to a full-production facility by 1991. This plant could be used for the isotopic purification of existing fuel-grade plutonium produced from past operation of the N-Reactor and from spent FFTF fuel.

AB-8 An alternative considered for production of defense nuclear materials after 1985 (the far-term) is the construction and operation of a New Production Reactor (NPR). The estimated time from the authorization of an NPR to its startup is about 10 years. Thus, an NPR could not contribute to material production until 1995 at the earliest, much too late to help offset the near-term need for defense nuclear materials.

BL-19, EN-10 The proposed restart of the L-Reactor at the Savannah River Plant, originally scheduled for October 1983, is the subject of this environmental impact statement. All the initiatives discussed above, including L-Reactor restart, are needed as soon as practicable to meet the increased defense nuclear material requirements. Any delays will directly affect the needed supply of defense nuclear materials for our Nation's nuclear force structure.

The President emphasized the importance of the timely restart of L-Reactor to increase the supply of nuclear material in his approval of the FY 1984-1989 Nuclear Weapons Stockpile Memorandum, on February 16, 1984, as follows: ". . . DOE shall . . . restart the L-Reactor at the Savannah River Plant, Aiken, South Carolina, as soon as possible."

This discussion on the need for L-Reactor is, by necessity, qualitative and limited because quantitative information on defense material requirements, inventories, production capacity, and projected material shortages or adverse impacts on weapons-system deployments is classified. A quantitative discussion of the need for restarting L-Reactor, including the impacts of delaying the restart, is provided for the DOE decisionmaker in a classified appendix (Appendix A).

1.2 PURPOSE

The purpose of this environmental impact statement is to analyze the potential environmental consequences of the proposed resumption of L-Reactor operation and its alternatives in compliance with Section 102(2)(C) of the National Environmental Policy Act of 1969, as amended, and the Energy and Water Development Appropriations Act, 1984. Also, on July 15, 1983, the U.S. District Court, acting on a November 1982 lawsuit, directed the DOE to prepare and publish an environmental impact statement as soon as possible on the proposed operation of L-Reactor.

The proposed action is to resume operation of L-Reactor as soon as practicable. The Department of Energy's preferred alternative is to operate L-Reactor after construction of a 1000-acre once-through cooling lake. TC

An environmental assessment on the L-Reactor restart was issued earlier in August 1982 (DOE, 1982a). This EIS describes production options considered (Chapter 2) and the affected SRP environment (Chapter 3), and assesses the potential environmental consequences of the resumption of L-Reactor operation and describes potential mitigation alternatives (Chapter 4).

Chapter 5 addresses incremental effects from other SRP facilities that would occur due to the resumption of L-Reactor operation and potential cumulative effects with nearby nuclear facilities.

Chapter 6 describes programs to study and monitor effluents from the SRP facility and to assess the ecological health of the SRP environment. Chapter 7 summarizes Federal and State of South Carolina requirements that apply to the proposed resumption of L-Reactor operation. Chapter 8 describes the unavoidable/irreversible impacts of L-Reactor operation.

Two EISs that address SRP waste-management operations and that are relevant in understanding potential environmental effects of the resumption of L-Reactor operation have been published in the last 6 years. The Environmental Impact Statement, Waste Management Operations, Savannah River Plant, Aiken, South Carolina (ERDA, 1977) describes the waste-management operations of the Savannah River Plant and analyzes their actual and potential environmental effects. The Environmental Impact Statement, Defense Waste Processing Facility, Savannah River Plant, Aiken, South Carolina (DOE, 1982b) describes the disposal strategy and the construction and operation of facilities at the Savannah River Plant to immobilize defense high-level radioactive wastes and analyzes the potential environmental effects.

The "SRP Ground-Water Protection Implementation Plan" will be the subject of a separate NEPA review. This review will cover such topics as seepage-basin decommissioning, cleanup levels, costs, schedules, and the need for institutional controls.

REFERENCES

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DOE (U.S. Department of Energy), 1982b. Environmental Impact Statement, Defense Waste Processing Facility, Savannah River Plant, Aiken, South Carolina, DOE/EIS-0082.

ERDA (U.S. Energy Research and Development Administration), 1977. Environmental Impact Statement, Waste Management Operations, Savannah River Plant, Aiken, South Carolina, ERDA-1537.