3 ALTERNATIVES AND PROPOSED ACTION

The planning process for the second source of naval fuel materials, designated the Fuel Materials Facility (FMF), considered various siting alternatives; these alternatives and the proposed action are described in this chapter.

3.1 ALTERNATIVES

Only one process has been qualified by the Naval Nuclear Propulsion Program to convert enriched uranium to the fuel material that possesses the high-performance characteristics needed. This process is being used by the single current supplier of fuel feed material. The time required to qualify alternative processes is estimated to be about 10 years, with an uncertain outcome. Therefore, alternative production processes were eliminated from further consideration.

As described in Chapter 2, the Department of Energy (DOE) explored the possibility of a commercial firm constructing and operating the Fuel Materials Facility and determined it was not a viable alternative. The Department determined that the facility should be built at a site where full Government control and maximum advantage from existing DOE facilities and resources could be realized.

A formal process was initiated to identify a preferred DOE site and an alternate DOE site for the Fuel Materials Facility. A set of siting criteria was established that led to the identification of the Savannah River Plant (SRP) as the preferred location for the Fuel Materials Facility and the Oak Ridge Reservation as the alternate location. The SRP site is preferred because it offers (1) better opportunities to use existing services, (2) site availability within existing safeguards and security systems, (3) greater distances from population centers, (4) better physical isolation, and (5) minimal impacts on the ecology. Appendix A describes the site selection process in detail.

The no-action alternative was considered and rejected as unacceptable for the reasons described in Section 2.1.

3.2 PROPOSED ACTION

The proposed action is to construct and operate a Fuel Materials Facility within the 200-F Separations Area of the Savannah River Plant. The estimated cost for the design and construction of this facility is 176 million dollars. This section describes the process, facility, and design features of the Fuel Materials Facility that are related to safety and impacts to the environment.

3.2.1 Process description

The Fuel Materials Facility will convert enriched uranium hexafluoride (UF_6) into a fuel material suitable for use in the fabrication of naval reactor cores. To meet exacting standards for naval applications, the manufacturing and recovery steps are tightly controlled. Feed material, manufactured fuel material, scrap, and waste are measured, analyzed, and monitored for their uranium content and for the presence of impurities. The finished product is tested and inspected before it is shipped as fuel material to be fabricated into reactor cores. Scrap material and, to the extent possible, chemical reagents are recovered and recycled in the main process stream.

The process system is designed geometrically to eliminate the possibility of a nuclear criticality. This means that all pieces of process equipment have small diameters, limited total volumes, and appropriate spacing.

3.2.2 Description of proposed facility

The conceptual layout of the FMF building (approximately 5000 square meters, or 62,400 square feet) is shown in Figure 3-1. The overall building dimensions are 96 meters by 71 meters.

A second level in the process area of the building will cover between one-quarter and one-half of the area of the ground floor. This level will contain the upper portion of the tall process equipment and the process ventilation equipment. Ventilation fans will be located on the roof of the first level.

The process area (see Figure 3-2) will be of a high-resistance construction that can withstand such extreme conditions as the highest winds expected to occur in 100 years and seismic loads. The vault adjacent to the process area will be hardened to meet DOE vault criteria. Other support buildings will be of standard construction with external covers of insulated metal siding. Building specifications and construction will comply with the requirements of DOE Order 6430 (draft).

3.2.2.1 Total containment concept

The Fuel Materials Facility will consist of several levels of containment, called the total containment concept, which is designed to minimize the exposure of the operating staff and the public from uranium and process chemicals. The process equipment provides the first line of containment. To prevent releases from inadvertent leakage or discharges from the process equipment, it is contained further within an enclosure, which constitutes a second barrier. This barrier will consist of the following types of systems: (1) dry cabinets (some using inert atmospheres), (2) wet cabinets, (3) fume hoods, and (4) solution storage enclosures. Each system will be equipped with sumps, as applicable, to catch and contain leakage.

The FMF building will be designed to provide additional barriers to the release of materials: the operating areas, the process area, and the building shell provide additional containment. These areas are interconnected through air locks and controlled ventilation that are designed to prevent the spread of any potential chemical or uranium contamination. These containment barriers are maintained by separate ventilation systems, discussed in the next section.

3.2.2.2 Ventilation system

As part of the total containment concept, the FMF ventilation system will assure forced-air circulation in seven areas, which consist of (1) the clean area, (2) the laboratory, (3) controlled-access areas, (4) the filter room, (5) enclosures and fume hoods, (6) wet and dry cabinets, and (7) the process vent system. The design objectives of the ventilation system are to (1) prevent the spread of radioactive contamination from an area with a higher contamination level to one with a lower contamination level, (2) remove chemical fumes from process areas, (3) ensure protection of critical equipment, and (4) provide comfortable conditions for personnel. Air supply systems contain fresh air filters and heating and cooling capability.

The ventilation operations will be based on providing (1) air flow from low to high potential contamination areas, (2) once-through air for areas with significant potentials for contamination, (3) a recirculating atmosphere in areas with low contamination potential, (4) high-efficiency particulate air (HEPA) filtration on exhausts from all potential contamination areas, and (5) separate vessel vent systems to remove chemical contaminants from process vessel exhausts. Such filters preclude any significant release of particulate radioactivity to the air exhausts. All ventilation exhaust will be discharged to the atmosphere through a stack with a preliminary design height of 61 meters. Effluents will be monitored and corrective actions will be initiated when releases exceed predetermined conditions, which will be established to limit releases within acceptable standards.

Process exhaust systems will use HEPA filters. Standby filters and fans will be provided to ensure continuity of operation during emergencies and filter maintenance. Standby fans will start automatically when system alarms indicate a discharge pressure below prescribed levels. Supply fans will stop automatically if the exhaust fans fail to maintain negative pressures.

Process vessels and equipment will be vented to a process vessel ventilation system, which will provide a negative pressure on the vessels and equipment relative to their containment systems. The vent gases from most vessels and equipment will pass through a chemical scrubber to remove chemical fumes, after which they will be dehumidified and passed through HEPA filters before their discharge to the environment through the facility stack. The total ventilation flow from the facility is expected to be 50 cubic meters per second (105,000 cubic feet per minute). Almost all the flow will be discharged from the facility stack; 2.9 cubic meters per second will be discharged from rooftop vents.

3.2.2.3 Liquid waste treatment

Liquid waste from FMF operations will include effluents from process, recovery, and laboratory operations; the sanitary system; cooling system blowdown; and steam condensates. Process waste from the process, recovery, and laboratory operations will be separated by type. These wastes will contain discardable quantities of uranium and process chemicals including nitrates, chlorides, fluorides of ammonium, aluminum, and sodium; they also will contain trace quantities of process solvents (TBP-ultrasene, etc.). The process wastes will be neutralized before evaporation to ensure that the impurities are contained in the evaporator concentrate. The evaporator condensate will be sampled, analyzed, and discarded only if it meets the South Carolina National Pollutant Discharge Elimination System (NPDES) permit conditions. If it is outside these permit conditions, the condensate will be reevaporated and checked again to ensure that it meets permit conditions before discharge. The evaporator concentrate will be mixed with concrete and encapsulated as a block in steel containers. The concrete will minimize the leach rate of the chemicals in the waste. The encapsulated concrete block will be buried in the SRP Burial Ground, as described in Section 3.2.2.4. Other liquid wastes (from the sanitary system and cooling system blowdown) will be treated as required to meet South Carolina NPDES permit conditions, sampled, and discharged. The NPDES permit for the operation of the Fuel Materials Facility will be obtained from the South Carolina Department of Health and Environmental Control; the permit conditions will be established to protect the environment.

Small amounts of liquid organics will be discarded periodically from the facility. These organic wastes will be placed in existing solvent storage tanks in the SRP Burial Ground.

3.2.2.4 Solid radioactive waste

All radioactive waste from the Fuel Materials Facility have low levels of radiation; it will consist of (1) solid waste generated by the process waste-water treatment facility, (2) material such as paper and plastic generated in the potentially contaminated operating areas of the process building and laboratory, and (3) wastes consisting of expended or obsolete equipment.

All solid wastes will be identified, packaged, and measured for uranium content before they are buried as low-level wastes at the existing SRP Burial Ground. An estimated 140 cubic meters per year of solidified low-level waste from process waste-water treatment will be buried each year with about 570 cubic meters per year of other contaminated low-level waste.

3.2.2.5 Safeguards

The Fuel Materials Facility will contain large quantities of uranium-235 that require safeguards. Safeguards considerations include physical security and materials control and accountability. The Fuel Materials Facility will be designed and operated in accordance with the following applicable DOE orders:

- DOE Order 5630.1: Control and Accountability of Nuclear Material
- DOE Order 5630.2: Control and Accountability of Nuclear Materials, Basic Principles
- DOE Order 5632.1: Physical Protection of Classified Matter
- DOE Order 5632.2: Physical Protection of Special Nuclear Materials

The facility's physical security system will be part of the SRP physical security system.

Stringent controls will be employed throughout the manufacturing, storage, and shipment cycle to protect against unauthorized diversion of uranium. Proven measuring and analytical procedures and equipment will be employed as part of the materials control and accountability system. The facility's computer system will maintain inventory and control records and generate reports. Special process design considerations will be employed to ensure stringent uranium accountability.