U.S. NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS

ENVIRONMENTAL ASSESSMENT RELATED TO THE CONSTRUCTION AND OPERATION OF THE OCONEE NUCLEAR STATION INDEPENDENT SPENT FUEL STORAGE INSTALLATION

DOCKET NO 72-4 (50-269, -270, -287)
DUKE POWER COMPANY

October 1988

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

ENVIRONMENTAL ASSESSMENT

RELATED TO THE CONSTRUCTION AND OPERATION

OF THE OCONEE NUCLEAR STATION

INDEPENDENT SPENT FUEL STORAGE INSTALLATION

1.0 INTRODUCTION

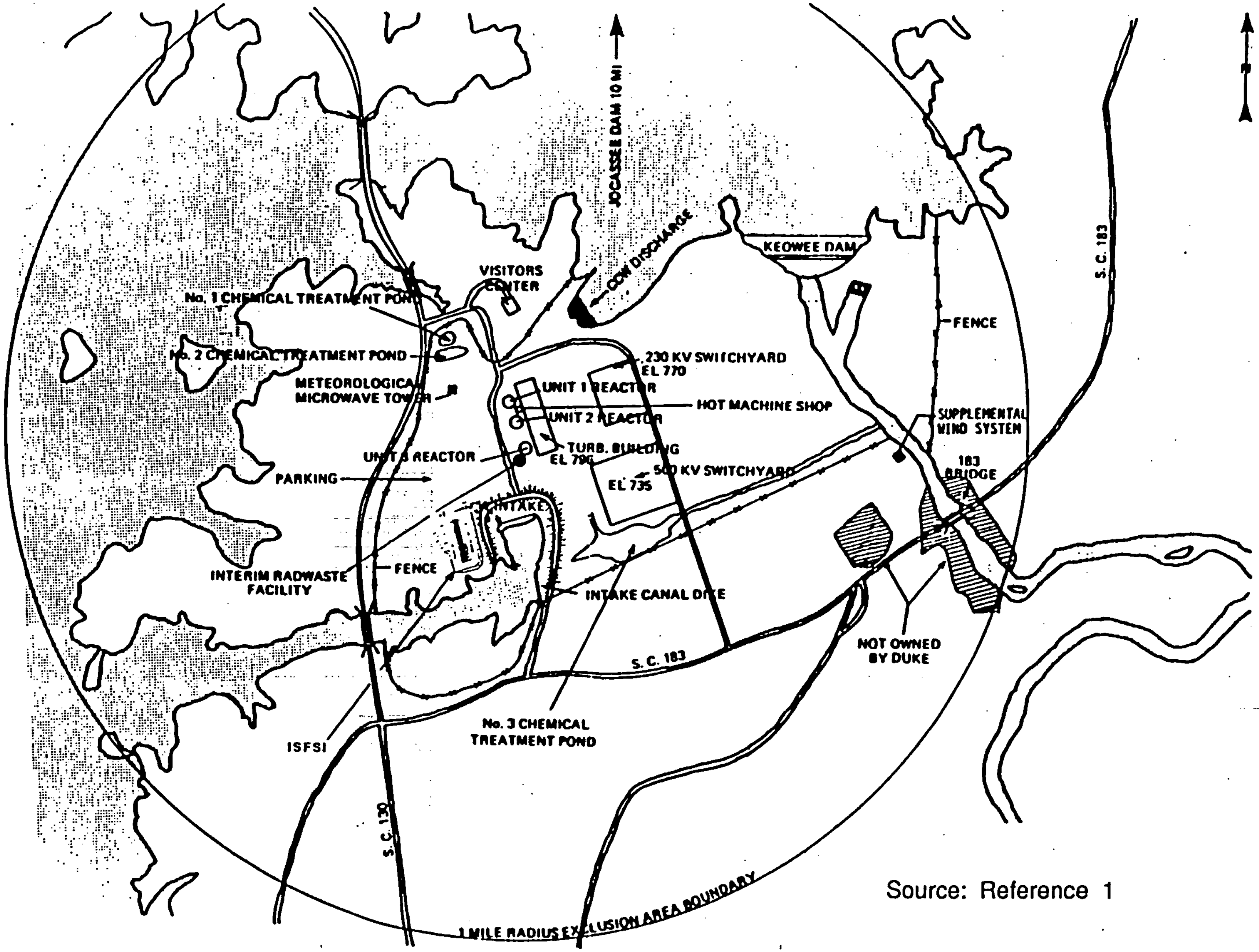
1.1 DESCRIPTION OF THE PROPOSED ACTION

By letter dated March 31, 1988, Duke Power Company (the Applicant) submitted an application for a license to construct and operate a Dry Independent Spent Fuel Storage Installation (ISFSI) to be located on the Oconee Nuclear Station site in Oconee County, South Carolina. The ISFSI or some other spent fuel storage system is needed in order to maintain a prudent operating reserve of spent fuel storage capacity in the two spent fuel basins on the Oconee site. This Environmental Assessment (EA) addresses the expected environmental impacts associated with the proposed construction and operation of the ISFSI on the Oconee Nuclear Station.

Duke Power Company owns and operates three 860 MWe nuclear generating units at the Oconee Nuclear Station. The proposed ISFSI will be located a few hundred feet west of the intake structure for the three unit complex. Figure 1.1 shows the location of the proposed ISFSI relative to the other features on the site including the reactor buildings and security fence. Figure 1.2 provides additional detail on the ISFSI layout.

The proposed ISFSI is a system designed by Nutech, Inc. of San Jose, California. It is referred to as the Nutech Horizontal Modular Storage System or NUHOMS-24P. The major components of this system are a dry shielded canister (DSC), a transportation cask, and a horizontal storage module (HSM). The DSC is placed inside the transportation cask, filled with 24 assemblies in the spent fuel pool, sealed, decontaminated, and transported to the storage area in a shielded transportation cask. Once in the storage area, the DSC is removed from the shielded transportation cask and placed into the HSM which provides bulk shielding and passive, natural convection heat removal. Figure 1.3 illustrates the DSC and HSM of the proposed Oconee ISFSI.

The Oconee ISFSI is designed to operate for 50 years, well beyond the operating life of the three reactors. Licenses issued for ISFSIs under Title 10 Part 72 of the Code of Federal Regulations (10 CFR 72) are for 20 years, but the licensee may seek to renew the license, if necessary, prior to its expiration.



Source: Reference 1

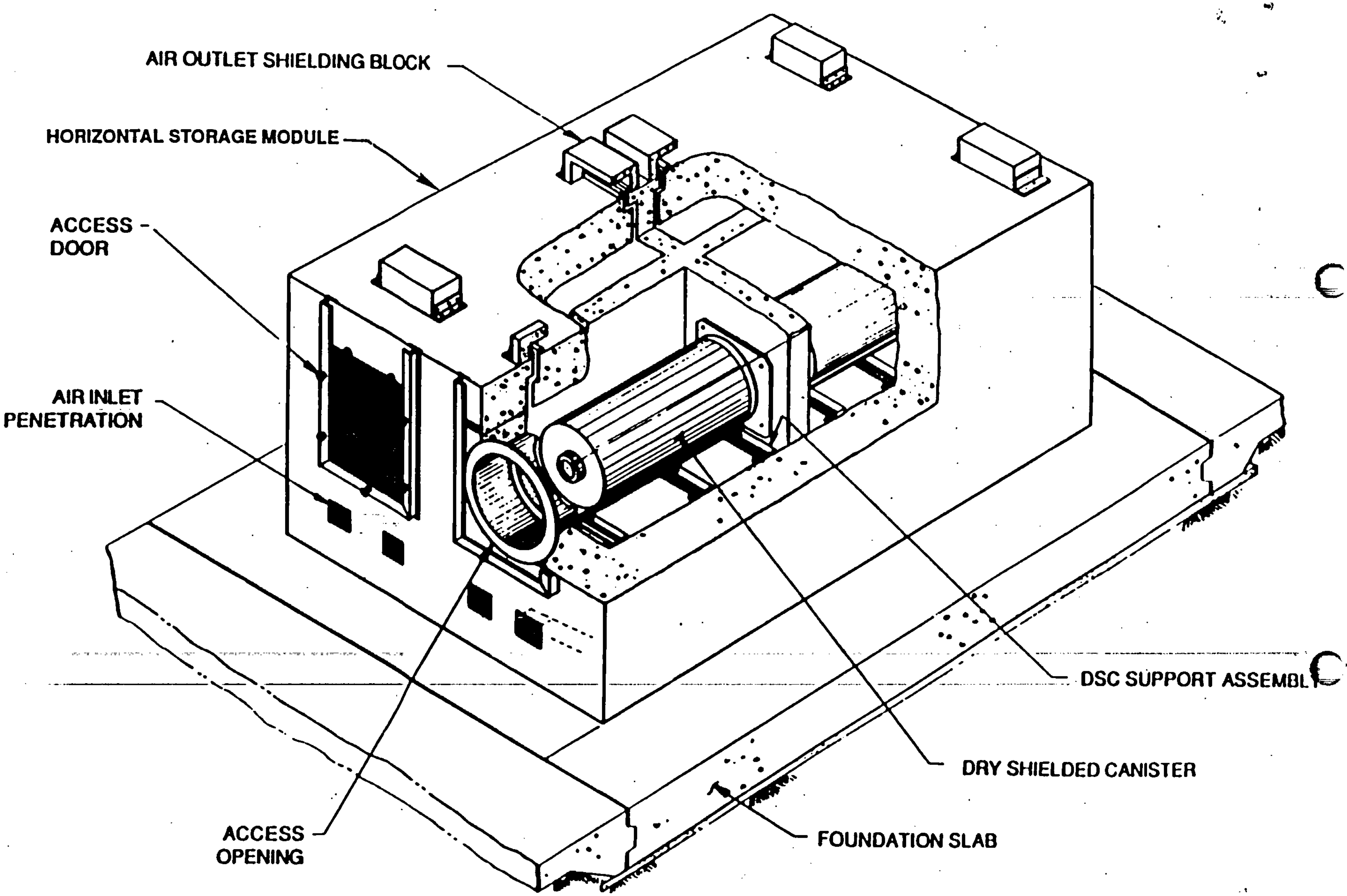
Figure 1.1 Location of the Duke Power Company Proposed ISFSI.

Security Related Information

Figure Withheld Under 10 CFR 2.390

Source: Reference 1

Figure 1.2. ISFSI Layout.



4

Source: Reference 2

Figure 1.3 NUHOMS-24P Horizontal Storage Module Components.

1.2 BACKGROUND INFORMATION

All three Oconee units were granted their construction permits in November of 1967. The first unit went critical in April of 1973 and began commercial operation in July of 1973. The second unit went critical in November of 1973 and began commercial operation in September of 1974. The third unit went critical in September of 1974 and began commercial operation in December of 1974. Prior to the mid 1970's, the nuclear industry in general and the Oconee Nuclear Station in particular, planned to store, for an interim period, spent fuel from nuclear-power reactors in a spent fuel pool at the reactor site where it was generated. After an indefinite interim storage period, utilities anticipated that spent fuel would be transported to a reprocessing plant for recovery and recycling of fuel materials. Reactor facilities, such as the Oconee units, were not designed to provide spent fuel storage capacity for life-of-plant operations.

Because commercial reprocessing did not develop as anticipated, the Nuclear Regulatory Commission (NRC), in 1975, directed the staff to prepare a generic environmental impact statement (EIS) on spent fuel storage. The Commission directed the staff to analyze alternatives for the handling and storage of spent fuel from light water power reactors with particular emphasis on developing long range policy. The staff also considered the consequences of restriction or termination of spent fuel generation through nuclear power plant shutdown. A "Final Generic Environmental Impact Statement (FGEIS) on Handling and Storage of Spent Light Water Power Reactor Fuel", NUREG-0575,[3] was issued by NRC in August 1979.

In the FGEIS, the storage of spent fuel is considered interim storage until the issue of permanent disposal is resolved and a plan implemented. Interim storage options evaluated in detail and included in the FGEIS are: (1) onsite expansion of spent fuel pool capacity; (2) expansion of spent fuel pool storage capacity at reprocessing plants; (3) use of ISFSIs; (4) transshipment of spent fuel between reactors; and (5) reactor shutdowns or deratings to terminate or reduce the amount of spent fuel generated.

The FGEIS concluded that an ISFSI represents the major means of interim storage at a reactor site once the spent fuel pool capacity has been reached. The FGEIS supports findings that the storage of light water cooled power reactor spent fuels in water pools, whether at the reactor or away-from-reactor sites, has an insignificant impact on the environment. While the environmental impacts of the dry storage option were not specifically addressed in the FGEIS, the use of alternative dry passive storage techniques for aged fuel appeared to be equally feasible and environmentally acceptable. In the case of both dry passive storage and wet storage, environmental impacts need to be considered on a site-the maximum licensed amount, have been shipped to McGuire over the past five years. With appropriate additional licensing actions, transhipment of Oconee spent fuel to McGuire or Duke Power Company's Catawba Nuclear Station could continue to be used as a storage option; however, such action would not alleviate the shortage of long-term storage space. Duke Power Company, therefore, proposes to solve the problem of inadequate spent fuel storage capacity at its Oconee Station through the construction of an onsite ISFSI. As required by 10 CFR 72, this assessment addresses the site-specific environmental impacts of construction and operation of the dry storage ISFSI at the Oconee Nuclear Station site.

1.3 PREVIOUS ENVIRONMENTAL ASSESSMENTS AND SUPPORTING DOCUMENTS

Several environmental documents have been prepared specific to the Oconee Nuclear Station site. A Final Environmental Statement (FES) related to the operation of the three unit Oconee Nuclear Station was prepared by the U.S. Atomic Energy Commission in 1972.[4] This document relied somewhat on information supplied by Duke Power Company in the its "Supplement to Environmental Quality Features of Duke Power Company's Keowee-Toxaway Project".[5] In addition, Duke Power Company initiated a five-year aquatic ecological monitoring program in response to licensing requirements. Results of this effort were compiled in a two volume environmental summary report.[6] Finally, an Environmental Report (ER) related to the proposed ISFSI for the Oconee Nuclear Station was submitted in March 1988,[1] and supplementary information was submitted in response to NRC questions in August 1988.[7] This EA is tiered on the 1972 FES, the 1988 ER with supplementary information, and the FGEIS (NUREG-0575). Additional information used in this assessment is provided in the applicant's Final Safety Analysis Report (SAR) for the operation of the Oconee Nuclear Station,[8] the SAR for the proposed ISFSI,[9] and the Nutech, Inc., "Topical Report for the Nutech Horizontal Modular Storage System for Irradiated Nuclear Fuel: NUHOMS-24P".[2]

2.0 NEED FOR PROPOSED ACTION

There are two spent fuel pools at the Oconee Nuclear Station, one which serves Units 1 and 2, and another which serves Unit 3. The combined capacity of the two pools was originally 552 storage positions, but with the two reracking efforts, the capacity of the dual pools has been increased to 2116 storage positions.

At the present time, 1429 positions in the two pools are filled. The remaining 687 available positions are less than that considered necessary to maintain a prudent operating reserve, 345 spaces per pool. This prudent operating reserve provides a capacity to accommodate a full core off-load (177 assemblies), and allows safe diver access for maintenance during a refueling outage.

The prudent operating reserve for the Oconee Unit 3 pool was lost in January 1987, and will be lost for the shared Unit 1/2 pool in February 1989. The ability to offload an entire reactor core, which is necessary during all Oconee refueling operations, will be lost in December 1990 for the Unit 1/2 spent fuel pool and in May of 1991 for the Unit 3 pool.

Additional spent fuel is being generated as the units continue to operate, and additional storage capacity will be required in order to recover and maintain the prudent operating reserve of spent fuel storage capacity. The proposed action would provide the additional capacity required to store spent fuel expected to be generated at the Oconee Nuclear Station through the year 2003.

3.0 ALTERNATIVES

Duke Power Company evaluated a number of alternatives for the storage of spent nuclear fuel prior the selection of the dry storage ISFSI. The alternatives did not sufficiently meet the requirements for storage of spent nuclear fuel generated at the Oconee Nuclear Station. A brief discussion of these alternatives follows.

Permanent Federal Repository

If a permanent Federal repository were available, the favored alternative would be to ship spent fuel to the repository for disposal. The Department of Energy (DOE) is currently working to develop a repository as required under the Nuclear Waste Policy Act (NWPA), but is not likely to have a licensed repository ready to receive spent fuel before 2003. This alternative, therefore, does not meet the near-term storage needs of the Duke Power Company.

Reracking of the Oconee Spent Fuel Pools

As discussed in Section 1.2, by twice reracking the spent fuel pools at the Oconee Nuclear Station, the pools have reached their maximum structural capacity.

Transshipment to other Duke Power Company Nuclear Plant Sites

Duke Power Company has transshipped 300 spent fuel assemblies, the maximum currently licensed amount, from the Oconee site to the McGuire site. Duke Power Company can consider transshipment to its Catawba or McGuire Nuclear Station spent fuel pools as a viable alternative to meeting its near-term spent fuel storage needs at Oconee; however, this alternative is not considered attractive because it does not add any additional storage capacity to the Duke Power Company system.

Full Scale Rod Consolidation

Full scale rod consolidation is also a viable alternative. However, this alternative appears less attractive than that of the ISFSI because of technology uncertainties, current consolidation rates, and uncertainties about DOE acceptance of non-fuel bearing components that would be generated by consolidation.

4.0 ENVIRONMENTAL INTERFACES

The general environment around the Oconee Nuclear Station is well characterized as a result of the studies conducted in support of construction of the Keowee-Toxaway Project, a project consisting of a series of man-made lakes serving nuclear, hydro and pump storage generation, as well as those conducted for the Oconee Nuclear Station. This section briefly reviews the environment with emphasis on those environmental features that are most likely to be affected by the construction and operation of the ISFSI. The assessment of construction and operational impacts is presented in Chapter 6.

4.1 SITE LOCATION, LAND USE AND TERRESTRIAL RESOURCES

The proposed ISFSI will be located within the existing fenced plant site area for the Oconee Nuclear Station, west of the cooling water intake and less than 2000 feet from the existing reactors. The area is partially wooded with second growth mixed pine and hardwood; a portion of the area is currently used for employee parking. The total storage area associated with the full 88 modules is estimated to be 510 feet by 253 feet. There will be an access road 30-feet wide by 450-feet long leading from the existing developed portion of the site to the proposed ISFSI storage area. The total area developed for the ISFSI will be slightly more than 3 acres within the 1500 acre Oconee site.

The Oconee site is located at the southern reach of Appalachia where the Piedmont hills join the southern Blue Ridge Mountains to form the Piedmont Crescent of South Carolina. It is in the eastern portion of Oconee County, South Carolina, approximately 8 miles (13 km) NNE of the town of Seneca, South Carolina at 34.8 degrees north latitude and 82.9 degrees west longitude. Lake Keowee, which serves as a heat sink for waste heat from the reactors, as well as a source of hydroelectric power, is located north and west of the site.

Duke Power Company owns and controls all property within a 1-mile exclusion area (1 mile from the center of Oconee Unit 2) except for a small rural church and cemetery (discussed in Section 4.3), rights-of-way for existing highways, and approximately 10 acres of U.S. Government property involved with the Hartwell Reservoir. South Carolina Highway SC 45/130 passes to the west of the plant and highway SC 183 passes to the south, through the site's 1-mile exclusion area. The centerline of the ISFSI is approximately 1,400 feet (427 m) south-southwest of the Unit 2 Reactor Building placing it approximately 3,900 feet or 0.74 miles (1.2 km) from the controlled boundary in the south-southwest direction.

The ecology of the site is well characterized as a result of surveys performed for the Keowee-Toxaway Project and the nuclear power plant. The area proposed for the ISFSI is a disturbed area and does not represent a critical habitat for any species. There are no known plant or animal species located onsite that are listed by the U.S. Fish and Wildlife Service as endangered. Bald eagles are occasionally sighted on Lake Keowee and Lake Jocassee, although no nesting populations have been reported. The South Carolina Wildlife and Marine Resources Department is conducting a program to reintroduce Peregrine falcons on Lake Jocassee, approximately 12 miles north of the Oconee Nuclear Station.

Within a 5-mile radius of the site, most of the land is wooded and rural in nature, with a large portion of the western half occupied by Lake Keowee. There are no oil or gas pipelines, airports, railroads, large military, or industrial facilities in the area. The major portion of cleared land lies east of the site. This and relatively small amounts of cleared land to the west are used for agricultural activities, e.g., dairy farming, fruit and cotton growing, and other general farming. The land near Lake Keowee has undergone some recent development as part of public and private recreational areas. Residential development of the Lake Keowee shoreline, outside of the Oconee plant exclusion area, is expected to be the major use of nearby land and water. Lake Keowee's 300-mile shoreline is expected to be fully developed by the early 1990's. Commercial development is anticipated to increase in response to the residential development.

4.2 WATER USE AND AQUATIC RESOURCES

The ISFSI will be located near the shoreline of Lake Keowee, a lake which was developed to provide cooling water for the three Oconee units and to serve as a source of hydroelectric power for the Keowee Hydroelectric Station. The city of Greenville and the town of Seneca take their raw water from Lake Keowee; the Greenville water intake is approximately 2 miles north of the site, while the Seneca water intake is approximately 7 miles south of the plant. Additionally, the towns of Anderson, Clemson, and Pendleton, Clemson University, and several industrial plants draw their raw water from Hartwell Reservoir which is downstream from Lake Keowee. The lake is also used for recreational purposes, including fishing, boating, and swimming. Detailed information on fish species and other aquatic species of Lake Keowee is provided in References 4 and 5.

4.3 SOCIOECONOMICS, AND HISTORICAL, ARCHEOLOGICAL, AND CULTURAL RESOURCES

The immediate area surrounding the Oconee plant site is rural. Despite the anticipated lakeshore population growth, and resultant increase in commercial enterprise noted in Section 4.1, no significant industrialization is expected, and the socioeconomic character of the area will remain basically unchanged. Similarly, the additional workforce required during construction will not be of sufficient size or their stay of sufficient duration to affect the basic socioeconomic characteristics of the local area.

There are no known archeological or cultural resources in the local area. There is, however, one historical site, Old Pickens Church and Cemetery, located about 3600-feet east of the proposed ISFSI site within the exclusion area.

4.4 DEMOGRAPHY

The population density in the vicinity of the Oconee Nuclear Station is generally low. There are currently no residences within 1 mile of the plant. The closest residence to the ISFSI is 1 mile southwest of the plant. Additional residences are located within 1.5 miles in all directions with the exceptions of the north, north-northeast and northwest sectors. In the future, the nearest resident might be located as close as 0.74 miles from the ISFSI in the south-southwest direction, which corresponds with the closest distance to the boundary of the site's 1-mile exclusion area.

Nearby population centers include two condominium projects (Keowee Key and Keowee Harbors) located about 5 miles north of the plant on the western shore of

Lake Keowee. These are occupied by some 2000 people, a large portion being permanent residents. There are also four towns within 10 miles of the plant with locations and populations as follows:

Town	Distance/Direction	Population
Walhalla	10 mi West	50,000
Salem	10 mi North-northwest	2,590
Seneca	8 mi South-southwest	8,200
Clemson	8.5 mi South-southeast	7,000

The two counties that border the plant area and constitute about a 20-mile radius are Oconee and Pickens, with populations of approximately 53,000 and 87,500, respectively. The growth rate within this area is estimated at about 16 percent by the Appalachian Council of Governments.

In addition to the resident population, the area is home to a relatively large transient population. Recreational use of Lake Keowee has given rise to an increasing transient population in the area. This transient population is estimated to reach 36,000 by the early 1990's when the shoreline is fully developed. Based on an estimate of the distribution of shoreline, about two-thirds of this transient population may be expected to reside within a 1 to 5-mile radius of the site, with the remainder residing from 5 to 10 miles from the site. Also, the town of Clemson houses a transient population of 13,062 at Clemson University in addition to its resident population.

Population projections for the area estimate almost 8000 persons will be located within 5 miles of the site, and 85,000 persons in the 5- to 10-mile range by the year 2020. At that time, the total resident population within 50 miles of the site will be about 1.42 million persons. The sum of resident and transient populations is expected to be about 32,000 persons within the 5-mile zone; 110,500 within the 5- to 10-mile radius; and a total 1.47 million within the 50-mile radius.

4.5 METEOROLOGY

The Oconee site lies along Lake Keowee within an area of moderately rolling terrain in the lee of the Appalachian Mountains. The region is characterized by a relatively high frequency of light wind speeds and calm conditions. The prevailing air flow is affected by local lake effects, as well as large scale pressure effects, predominantly semipermanent high pressure which dominates the area. Winds are primarily from the southwest and northeast quadrants, with average annual wind speeds of 6.6 mph. Precipitation amounts are distributed rather uniformly throughout the year, with typical amounts of 50 to 55 inches annually. Additional climatological data is available in the ER.[1]

Extremes of weather include maximum wind speeds of 79 and 73 miles per hour recorded at Greenville and Clemson, South Carolina, respectively. Extremes in temperature have ranged from -7 to 104 degrees Fahrenheit at Clemson during a 68-year record. The heaviest total annual precipitation recorded in Clemson was 73 inches during 1936, which is about 21 inches above normal. The heaviest snowfall recorded was 14 inches in 1930. Hail events resulting in more than one inch of ice accumulation may be expected once each 15 to 20 years.

The area experiences about 70 thunderstorms per year, and tropical storms may at times affect the area. Hurricane force winds are not expected to affect the Oconee area because of its distance from the coast and the hurricane's typical rapid dissipation with movement onshore; however, such storms can bring heavy rainfall to the region, with amounts of 9 to 10 inches falling within a 24-hour period.

The expected number of tornadoes in the region is approximately 3×10^{-4} tornadoes per square mile per year (or less than one tornado per square mile each 3000 years). This estimate is based on a compilation of tornado occurrences (as evidenced by tornado sightings or otherwise determined through investigations of damage) within 125 nautical miles of the site during the years 1950 through 1987[10]. The majority of the tornado occurrences (49.4%) in this area have been characterized as weak, capable of moderate damage, with wind speeds of 73 to 112 mph. Twenty-eight percent have been considered strong, capable of considerable damage, with speeds of 113 to 157 mph. Another eight percent fall into the range of severe (4%) and devastating (4%), with winds of 207 to 318 mph.

4.6 GEOLOGY AND SEISMOLOGY

The Oconee Nuclear Site is located within the Inner Piedmont Belt, the westernmost component of the Piedmont Physiographic Province. The regional geology is typical of the southeastern Piedmont, having narrow metamorphic belts trending northeast and dipping generally to the southeast. Overlying the foundation bed are saprolite soils, a weathering product of the underlying parent rock. These soils, ranging in thickness from a few feet to over 100 feet (30 m), show decreasing degrees of weathering and decomposition with increasing depth. A light to medium gray granite gneiss is dominant among the three rock types found at the site. Second most abundant is the biotite hornblende gneiss. Most likely due to the higher percentage of biotite mica, this rock is generally weathered (i.e., softer) to a greater depth than the granite gneiss. The third rock type, a hard quartz pegmatite with local concentrations of mica, is present in layers generally less than three feet. Test borings at the ISFSI site indicate that liquefaction of soils is not a concern because all foundation materials are non-liquefiable. The ISFSI's concrete foundation will rest on either soil or partially weathered rock.

Since plant construction, there have been two moderate earthquakes in the immediate vicinity. On July 13, 1971, an earthquake with an estimated Modified Mercalli (MM)[(1)] intensity ranging from IV to VI (indicating no to slight damage) occurred near Seneca, South Carolina. On August 25, 1979, a magnitude 3.7 on the Richter scale earthquake occurred near Lake Jocassee, South Carolina. Following that quake, 26 aftershocks ranging in magnitude from 0.60 to 2.0 were recorded between August 26 and September 15, 1979. The largest earthquake in the region occurred near Charleston, South Carolina, (approximately 200 miles (322 km) from the site) in August 1886. The shock intensity at the epicenter has been estimated as MM IX (considerable damage to structures). Aftershocks of the main earthquake had intensities as high as MM VII (slight to moderate damage to structures).

---

(1) The MM scale (which is a qualitative measure of the intensity of an earthquake, based on the extent of damage on a scale of I to XII) is in use as an estimate of seismic activity for events which occurred prior to the availability of seismographic instrumentation which is currently used in conjunction with the Richter scale (which is a measure of the amount of energy at the earthquake source).

5.0 DESCRIPTION OF THE OCONEE NUCLEAR STATION ISFSI

5.1 GENERAL DESCRIPTION

The proposed ISFSI involves physical components and a system of procedures designed to be used in a complementary fashion to protect onsite personnel and the general public from radioactivity in the spent fuel, and to maintain the integrity of the confinement and shielding barriers which provide this protection. The physical components of the proposed ISFSI are described in Section 5.2, while the operational procedures are described in Section 5.3. The planned monitoring program for the ISFSI is described in Section 5.4.

5.2 ISFSI DESIGN

The ISFSI provides for the horizontal, dry storage of irradiated fuel assemblies in a concrete module. There are six major physical components associated with the proposed ISFSI. These are the spent fuel, the dry shielded canister (DSC), the transfer cask, the transfer trailer, the horizontal storage module (HSM), and the hydraulic ram. Each of these components is discussed below. Detailed design information is presented in Reference 2.

Spent Fuel

Spent fuel, because of its radioactive nature, presents a potential hazard to plant personnel, the general public, and the environment. The ISFSI system is designed to safely store spent fuel by confining the fuel material and providing bulk shielding from radiation.

Duke Power Company has identified the spent fuel assemblies to be stored in the ISFSI. Specifically, the spent fuel must comply with the restrictions listed in Table 5.1 before it will be transferred to the ISFSI. These restrictions are based on the need to assure that: (1) there is no potential for nuclear criticality; (2) maximum allowable fuel clad temperatures are not exceeded; and (3) dose rates outside the HSM are within the allowable design limits.

Dry Shielded Canister

The DSC provides the primary confinement of the fuel. It consists of a stainless steel cylinder with an internal structure of discs and rods with discrete storage positions for 24 pressurized water reactor (PWR) spent fuel assemblies. There are shielded end plugs for the DSC which reduce the radiation field at the ends of the cylinders.

Transfer Cask

The transfer cask is used to transport the loaded DSC either from the spent fuel pool in the reactor area to the ISFSI, or from the ISFSI to the fuel pool. The cask has both lead gamma shielding and a water-based solution for neutron shielding. There are removable plates at the two ends so that the DSC can be placed in and removed from the transfer cask. There are also lifting trunnions on the cask so that it can be moved into and out of the fuel building, and lifted onto the transfer trailer.

Table 5.1. Design Parameters for the Oconee ISFSI

Category	Criterion or Parameter	Value
Fuel Acceptance Criteria	Initial Fissile Content	4.0% ^{235}U with credit for burn-up
	Radiation Source	
	Gamma	4.62×10^{15} photons/sec/assembly
	Neutron	1.54×10^{8} neutron/sec/assembly
	Heat Load	0.66 Kw/Assembly
Dry Shielded Canister	Capacity per Canister	24 PWR Fuel Assemblies
	Size	
	Length (typical)	4.74 m (187 in.)
	Diameter	1.71 m (67 in.)
	Temperature (max. long-term fuel rod clad)	340 degrees C (644 degrees F)
	Cooling	Natural Convection
	Design Life	50 Years
	Material	304 Stainless Steel with Lead End-Shields
	Internal Helium	2.5 psig ± 2.5 psig
Horizontal Storage Module	Capacity	1 Dry Shielded Canister per Module
	Size	
	Length	6.1 m (20 ft.)
	Height	4.6 m (15 ft.)
	Width	2.6 m (8.7 ft.)
	Average Surface Radiation Dose Rate (area weighted average)	20 mrem/hr
	Material	Reinforced Concrete
	Design Life	50 years

Transfer Trailer

The transfer trailer is used to transport the transfer cask between the fuel building and the ISFSI.

Horizontal Storage Module

The HSM is a reinforced concrete shield structure used to store the DSCs. The HSM provides shielding as well as heat removal by natural convection.

Hydraulic Ram

The hydraulic ram is used to move the DSC from the transfer cask into the HSM or from the HSM into the transfer cask.

5.3 ISFSI OPERATIONS

The ISFSI will be operated according to procedures which will be incorporated into the existing system of Oconee Nuclear Station procedures. The major steps associated with the placing of fuel in the Oconee ISFSI are presented in Table 5.2. As part of these operations, a number of specific actions will be taken to assure protection of operators as well as the general public. The major specific actions are:

Preoperational Testing

Prior to any transfer or loading of spent fuel, Duke Power Company will perform dry runs with the various ISFSI components to ensure the operability of system components and procedures. Any problems identified during these preoperational tests will be resolved through modification of equipment or procedural changes.

Component Quality Assurance

Quality assurance procedures will be applied to the acceptance of key ISFSI equipment. The highest level of quality assurance will apply to the DSC and the transfer cask. Lower levels of quality assurance will apply to items which are less critical for the protection of operators and the general public, including the HSM and onsite construction activities.

Fuel Selection

Specific procedures along with quality assurance checks will be applied to the fuel selection process to ensure that only appropriate fuel is selected for loading into the ISFSI.

Contamination Control of the DSC Exterior Surfaces

Because external surfaces of the DSC will be directly exposed to the atmosphere as part of the canister cooling process, Duke Power Company will take steps to keep exterior surface as contamination free as possible. This will minimize the potential for release of radioactive material to the environment.

Table 5.2. Major operational steps for transferring fuel from the Spent Fuel Pool to the ISFSI[1]

1. Receive, inspect and accept the manufactured DSC.
2. Position the DSC in the transfer cask, fill the DSC and cask with water, and lower the transfer cask containing the DSC into the spent fuel pool.
3. Load the previously selected spent fuel assemblies into the DSC.
4. When loading is complete, position the top end shield plug in the DSC.
5. Move the loaded DSC/transfer cask combination from the pool to the decontamination pit.
6. Lower water level in both the DSC and the transfer cask and weld the top end shield plug to the DSC body.
7. Purge and dry the DSC, fill with helium, seal the DSC fill and drain ports, weld the DSC top cover plate in place, and decontaminate the upper DSC surface and the transfer cask exterior if necessary.
8. Drain the water from the transfer cask and position the transfer cask with the filled and sealed DSC on the transfer trailer.
9. Transport the transfer cask and DSC to the ISFSI site.
10. Inspect the interior and exterior of the HSM.
11. Position the trailer next to the inspected HSM and align the DSC with the HSM opening.
12. Transfer the DSC from the transfer cask to the HSM.
13. Close the HSM and return the transfer cask and transfer trailer to their storage position.

---

(1) Steps for removing the fuel from the DSC are not addressed above, but are considered in References 1 and 9.

Radiation Protection Procedures

The operation of the ISFSI will be according to the general radiation protection program which is already in place at the Oconee site.

Training

The operators for the ISFSI will be trained in the principles and requirements of the ISFSI.

Normal and Emergency Procedures

Normal and emergency procedures will be established for the operation of the ISFSI and adhered to by all personnel.

5.4 MONITORING PROGRAM

An effluent monitoring program is not applicable to the ISFSI, because its operation will not result in any water or other liquid discharges; it will not generate any chemical, sanitary, or solid wastes; and it will not release any radioactive materials in solid, gaseous or liquid form during normal operations. Similarly, with the lack of liquid or gaseous effluents from the ISFSI, special environmental monitoring for these exposure pathways is not necessary. Therefore, a separate environmental measurement program for ISFSI is not warranted; however, to help assure proper operation of the ISFSI system, Duke Power Company will incorporate ISFSI monitoring into the Oconee site monitoring program. The site operational surveillance program will also be expanded to include surveillance of the ISFSI.

The Oconee Nuclear Station maintains an air, water and food pathway monitoring program which establishes the basis for evaluation of environmental impacts of facility operation, and is used in the assessment of public and occupational dose from Oconee operations. This environmental surveillance program has been conducted continuously at the Oconee Nuclear Station since 1969. The program is designed to confirm that Duke Power Company operations are within regulatory requirements and consistent with the documented As Low As Is Reasonably Achievable (ALARA) program. The main thrust of the health physics and ALARA programs is to minimize exposure to radiation such that the total exposure to personnel in all phases of design, construction, operation and maintenance are kept ALARA. A main component of Duke Power Company's ALARA program is trend analysis designed to assure that any necessary corrective actions can be taken sufficiently early to prevent unnecessary exposure. The ISFSI operations are included in the existing ALARA program for the Oconee Nuclear Station.

Levels of external radiation exposure from the ISFSI will be estimated by environmental dosimeters strategically placed to confirm that radiation exposures to direct and scattered radiation are as predicted. Changes in ISFSI inventory will be factored into the radiation dosimetry assessment. No measurable increase in radiation levels above normal background is anticipated beyond the Oconee 1-mile controlled area.

An operational surveillance program will be instituted to monitor the safe operation of the ISFSI. Once each 24 hours, site personnel will visually inspect all air inlets of each loaded HSM for obstructions and screen damage. As necessary, removal of obstruction or screen repair will be initiated immediately. The ISFSI will also be included in routine site patrols by Oconee security personnel.

Monitoring program results are published annually. The ongoing monitoring program is described in Reference 6 and results for the most recent 1-year program are contained in Reference 11.

6.0 ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

6.1 CONSTRUCTION IMPACTS

The ISFSI site area will be developed and managed so as to minimize construction impacts. All construction activities will comply with Federal, State and local regulations governing safety and health for construction, as will all operations in connection with the transportation, storage, and use of explosives. Work will be monitored by Duke Power Company personnel.

Construction will be phased according to need. Initial requirements for storage will be met by construction of a 2 by 10 HSM array which will allow for three years of storage. Subsequent construction of HSMs will be required approximately every two years, at which time evaluations will result in the decision to construct a 2 by 3, 2 by 6, or 2 by 10 array.

6.1.1 Land Use and Terrestrial Resources

The eighty-eight storage modules and their access area will occupy a little over 3 acres (0.01 km^2) approximately 1100-feet (335 m) southwest of the reactor containment buildings. The area is totally within the Oconee controlled area; thus, no additional land use impacts will result from construction of the ISFSI. The area to be disturbed is partially barren of vegetation but includes some second growth trees. The terrain alteration, clearing, excavation and grading will result in a loss of biological production of less that one percent of the Oconee site area (3 to 4 acres).

Construction of the ISFSI is not expected to have any impact on any known species listed by either the Federal or State government as endangered. Likewise, construction is not expected to impact the South Carolina Wildlife and Marine Resources Department program to reintroduce Peregrine falcons to Lake Jocassee approximately 12-miles north of Oconee Nuclear Station.

Construction of the ISFSI will result in some onsite disposal of spoil material. Two prime candidate sites for spoil material disposal are an area 800-feet west of the ISFSI and an area immediately south of SC Highway 183. Measures will be taken to ensure that dust created during earthwork will be kept at an acceptable level and existing paved roads remain free of objectional amounts of earth and rocks. Burning permits will be obtained as needed and requirements for erosion control, such as silt fences, used as necessary.

A portion of the acreage proposed for the ISFSI is currently used for parking by Duke Construction and Maintenance Division - South (CMD-S) personnel during outages. This portion of the parking area will be lost, but the portion not used for the ISFSI will continue to be used by CMD-S as outage parking area. Additional parking southeast of the ISFSI will also be available for CMD-S personnel.

There is one historical site, Old Pickens Church and Cemetery, located about 3600-feet east of the proposed ISFSI site within the exclusion area. Construction of the ISFSI will have no impact on this site. However, in the unlikely event of an emergency or off-normal condition, Duke Power Company has the authority to close this site to the public, as well as access to SC Highways 45, 130 and 183.

6.1.2 Water Use and Aquatic Resources

Construction of the ISFSI is not expected to impact local water use, water quality or aquatic biota. Construction activities will not require the use of, or result in the discharge of any water. Erosion of topsoil or excavated material during site preparation will be contained within the immediate vicinity. Surface runoff from the ISFSI construction area will enter Lake Keowee along existing drainage routes. Soil dewatering during excavation is not anticipated as the existing water table is below the planned concrete ISFSI foundation level. Concrete for foundations and walls of the HSMs will be pre-mixed, thus no water use nor wastes from concrete batch operations will result.

6.1.3 Other Impacts of Construction

Air Quality

Temporary increases in levels of suspended particulate matter will result from construction activities. In addition, exhaust from construction vehicles will add to levels of hydrocarbons, carbon monoxide and oxides of nitrogen. Measures such as watering of unpaved haul roads will be used to minimize the generation of fugitive dust. In addition, cleared areas and exposed earth will be seeded, graveled, or paved to stabilize and control runoff, and minimize soil erosion.

Noise

Noise levels due to construction traffic, grading, and excavation are not expected to be greater than the noise associated with the normal operation of the Oconee plant. To protect onsite personnel, Occupational Safety and Health Administration standards will be followed.

6.1.4 Socioeconomics

Duke Power Company will utilize the existing construction workforce, supplemented by a very small, temporary additional workforce in the construction of the ISFSI. The peak requirement is for 50 workers. This small, temporary workforce will not impact the socioeconomic character of the area.

6.1.5 Radiological Impacts from Construction

Initially, there will be no radiological impacts from construction. However, occupational radiation exposure is expected to result from the construction of additional HSMs, after some are filled. These operations will be conducted under either (1) existing procedures suitably modified and approved for this activity, or (2) procedures to be prepared under the existing Duke Power Company administrative requirements which meet NRC Quality Assurance (QA) and ALARA requirements. Because radiation fields from filled HSMs are non-uniform, temporary shielding and access controls will be used as necessary to keep occupational exposure to construction workers ALARA. Estimates of construction-related doses are presented in Section 6.2.1.2.

6.2 OPERATIONAL IMPACTS

6.2.1 Radiological Impacts from Routine Operations

The primary pathway through which site workers and nearby residents may be exposed as a result of normal Oconee ISFSI operations is through external exposure to direct and scattered radiation. Radiological dose estimates were calculated for this pathway using conservative and design basis assumptions: maximum storage module surface dose rates of 37 mrem/hr neutron and 94 mrem/hr gamma; maximum fuel burn-up of 40 GWD/MTU (gigawatt-days per metric ton of uranium); and post-irradiation decay period of at least 10 years before dry storage. These assumptions result in conservative dose estimates; actual doses are expected to be somewhat lower.

Because the proposed ISFSI involves only dry storage of spent nuclear fuel in dry, sealed DSCs, there will be essentially no gaseous or liquid effluents associated with normal storage operations. Activities associated with cask loading and decontamination may result in some gaseous and liquid effluents; however, these operations will be conducted under the 10 CFR Part 50 operating license, and radiological impacts from those effluents fall within the scope of impacts from reactor operations which were assessed in the Oconee FES.[4]

6.2.1.1 Offsite Dose

ISFSI operations will result in a small additional dose to members of the public from direct radiation exposure. Section 72.104(a) of 10 CFR 72 requires that dose equivalents from normal operations to any real individual located beyond the ISFSI controlled area not exceed 25 mrem/yr to the whole body, 75 mrem/yr to the thyroid, and 25 mrem/yr to any other organ as a result of planned effluent releases, direct radiation from ISFSI operations, and radiation from other uranium fuel cycle operations within the region.

Appendix I to 10 CFR 50 sets forth design objective dose commitment guides for liquid and gaseous effluents released from nuclear power reactors. For each reactor, the maximum annual dose commitment to an individual in an unrestricted area is 3 mrem/yr due to liquid effluents and 5 mrem/yr due to gaseous effluents. Thus, the maximum design guide dose commitment from effluents due to operations of Oconee Units 1, 2 and 3 would be 24 mrem/yr. Current dose levels as a result of releases of radioactivity in effluents are less than the design level. Routine liquid and gaseous effluents contributed an estimated annual dose of 1.4 mrem to the whole body of a hypothetical maximum individual, averaged over a three-year period ending in 1987.[7]

With respect to direct radiation exposure, the design of the storage system (DSC and HSM) is such that the dose rate at the surface of the front (door) of an HSM is higher than that of side surfaces. With the alignment of the ISFSI, this results in highest dose rates (due to direct radiation) in the west-south-west and east-northeast directions. The point of public access nearest to the ISFSI is 0.74 mi. (1.2 km) in the south-southwest direction.[7] The estimated annual dose to an individual at this location due to air-scattered radiation from the fully loaded 88 storage modules is estimated to be about 0.4 mrem/yr. This dose is artificially high since it assumes full-time occupancy (i.e, 8760 hr/yr).

Nevertheless, it is still a small fraction of the design guide dose commitment, and those estimated in the FES for Oconee operations. The nearest resident is located 1 mi. (1.6 km) southwest of the HSM center.[7] The maximum expected dose to an individual at this location would be about 0.03 mrem/yr. When combined with the dose commitment from reactor operations, the total dose commitment is well within the 25 mrem/yr limit specified in 10 CFR 72.104 and 40 CFR 190. In addition, trees and hilly terrain between the ISFSI and these locations provide shielding, such that individuals here would essentially be exposed only to air-scattered radiation from the ISFSI.

There are currently no residents located less than 1 mi. (1.6 km) of the Oconee ISFSI, but in 2020 there are estimated to be about 525 people between 1 and 2 miles of the Oconee Station.[7] The collective dose to this population due to Oconee ISFSI operations is estimated to be about 0.007 person-rem/yr. The collective dose commitment to the current population due to Oconee reactor operations without the ISFSI (averaged over the past 3 years) is about 0.027 person-rem/yr.[7] For populations in the region under consideration beyond 2 miles from the ISFSI, direct and air-scattered radiation contribute very little to the collective dose commitment.

6.2.1.2 Collective Occupational Dose

Spent fuel storage at the Oconee ISFSI will result in a small increase in the total occupational dose at the Oconee site. Occupational radiation exposure for ISFSI operations is expected to result from loading fuel into the DSC, loading the shipping cask, moving the shipping cask to the ISFSI, inserting the DSC into the HSM, sealing the HSM, and conducting routine security checks and operational surveillance. Occupational doses to construction workers result from exposure to direct and scattered radiation from irradiated fuel in previously filled modules. Oconee Station workers not directly involved in ISFSI operations will be exposed to small increases in the general area radiation level.

Engineered features of the storage modules and application of administrative controls are designed to ensure that all exposures are maintained at levels which are As Low As Is Reasonably Achievable (ALARA). All ISFSI operations will be conducted under either (1) existing procedures suitably modified and approved for this activity, or (2) procedures to be prepared under the existing Duke Power Company administrative requirements which meet NRC Quality Assurance (QA) and ALARA requirements. Occupational doses will be controlled to within the limits of 10 CFR Part 20, i.e., the dose per calendar quarter must not exceed 1-1/4 rems to the whole body, head and trunk, active blood forming organs, lens of the eye, or gonads; 18-3/4 rems to the hands and forearms, feet and ankles; and 7-1/2 rems to the skin of the whole body.

The maximum annual collective occupational dose from the operation of the Oconee ISFSI has been estimated. Estimates for loading and transfer operations are based on emplacing a maximum of 10 DSCs in the 20 originally constructed HSMs during each of the first 2 years, and not more than 5 DSCs in subsequent years.[7] Estimates of dose during construction assume that 1500 person-hours per module are required to complete the 68 additional concrete storage modules. Calculation of dose to Oconee Station workers not directly involved in ISFSI activities assumes the ISFSI is fully loaded.

Table 6.1 presents the estimated maximum collective occupational doses from annual operation and construction of the ISFSI, while Table 6.2 estimates the annual collective dose to Oconee Station workers not directly involved in ISFSI activities. The maximum dose to ISFSI workers is about 13 person-rem/yr from operations, and 19 person-rem/yr for additional module construction. The dose to Oconee Station workers not directly involved in ISFSI activities is 5.5 person-rem/yr. These values constitutes a small, incremental fraction of the total occupational dose commitment at the Oconee Nuclear Station. During 1985, the collective occupational dose at Oconee was 1304 person-rem/yr, and the annual average collective occupational dose over 10 years, ending with 1985, was 1243 person-rem/yr. Once all 88 modules are loaded, the annual occupational collective dose would be less than one percent of the current average occupational collective dose.

6.2.2 Radiological Impacts of Accidents

A variety of accident scenarios which may affect the safe operation of the Oconee ISFSI have been postulated. These include earthquakes, tornadoes, tornado missiles, lightning, fires, pressurization of the DSC, blockage of air inlets and outlets, cask drop, leakage of the DSC, and loss of air outlet shielding. The canisters and storage modules are designed to withstand the resultant forces from these accidents. However, two of the postulated accidents have possible offsite radiological consequences. These are loss of air outlet shielding and canister leakage. Of these, canister leakage is the bounding case accident. For assessment purposes, an accident is postulated wherein a non-mechanistic simultaneous failure of the DSC and all fuel cladding occurs, resulting in the loss of the helium cover gas and 30 percent of the radioactive noble gas inventory in the spent fuel for one DSC. Tables 6.3 and 6.4 summarize the radiological impact of this DSC accident scenario. Release fraction estimates for ^{85}Kr, ^{129}I and ^{3}H are from Reference 7. The release fraction estimates for particulate radioactivity (i.e., ^{90}Sr, ^{106}Ru, ^{137}Cs and ^{134}Cs) used in this analysis were based on a worst-case scenario for air-cooled transfer casks.[12] This reference (Scenario 5), while not directly relatable to a non-mechanistic simultaneous failure of the DSC, is expected to provide a reasonable assumption. Further, this reference clearly indicates that particulate releases contribute an insignificant amount to the radiation dose. The cited scenario considers all release mechanisms that are credible for air-cooled casks.

Once radionuclides have been released from the fuel rods they must escape the DSC. The radioactivity released to the DSC cavity is based on the design fuel to be stored in the cask (PWR fuel, initial enrichment of 4.0 percent ^{235}U; 40 GWD/MTU burn-up; 10 years out of the reactor). The accident damage is not expected to provide a pathway with a large cross-sectional area from the DSC cavity to the environment; the most likely release pathway would consist of only a small section of a failed DSC seal. In addition to the small release area, radionuclides can condense, plate out, or be filtered out before escaping the DSC.

Table 6.1 Collective occupational dose to Oconee Station workers directly involved in ISFSI activities[1]

Operation	Person-rem per DSC	Person-rem per year for first 2 years	Person-rem per year after first 2 years
DSC Loading and Cask Decontamination at Reactor	0.88	8.8	4.4
Transfer DSC to and Emplacement in HSM	0.17	1.7	0.85
Surveillance and Maintenance[2]	-	3.8	7.6
Construction of additional HSMs	3.75	0	18.8[3]

[1] Estimates are based on the following assumed construction and loading schedule: 20 HSMs are constructed initially, and 10 DSCs are loaded for each of first 2 years. After second year, HSM construction rate and DSC loading rate equal five per year.

[2] Surveillance and maintenance is assumed to require 1 hr/day for general surveillance, 1 hr/day for air inlet/outlet inspection, and 40 hr/yr for general maintenance.

[3] Total radiation dose for the construction of 88 HSMs is about 255 person-rem.

Table 6.2 Estimate of collective dose to Oconee Station workers not directly involved in ISFSI activities

	No. of employees	Dose rate (mrem/hr)	Annual dose (person-rem/yr)[1]
Nuclear Production			
Trash Segregation Area	5	0.06	0.115
Radwaste Facility	10	0.04	0.154
Tech Support Bldg	45	0.03	0.518
Unit 3 Operations	70	0.02	0.538
Warehouse #6	5	0.04	0.077
Unit 1,2 Operations	120	0.005	0.230
Maintenance & Service	365	0.002	0.280
Administrative Annex	195	0.004	0.300
Other Nuc. Prod.	87	0.005	0.167
Support Personnel	110	0.005	0.211
Vendors[2]	260	0.005	0.499
Construction			
CMD Facility	263	0.0003	0.030
Oconee (Station)	702	0.005	1.348
Storage Yard	16	0.001	0.006
Warehouse #5	9	0.005	0.017
Vehicle Maint. Facility	22	0.0002	0.002
Offsite	142	0	0
Total	2426		4.493

(1) Station personnel are assumed to be exposed for 1920 hr/yr with an average indoor/outdoor protection factor of 5.

(2) Vendors are not Duke Power Company employees, but are included here to provide a conservative estimate of the total collective dose.

Table 6.3 Expected dose at the controlled area boundary resulting from a dry shielded canister leakage accident at the Oconee Nuclear Station (1)

Whole Body Dose

Nuclide	DSC inventory (uCi)	Release fraction	X/Q (sec/m^3)	Breathing rate (m^3/sec)	Tot. body inhalation DCF[13] (rem/uCi)	Dose at boundary (rem)
H-3	4.30E+09	3.00E-01	5.15E-04	2.54E-04	1.20E-04	2.02E-02
Kr-85	6.60E+10	3.00E-01	5.15E-04	1.00E+00	3.34E-10 (2)	3.41E-03
I-129	4.49E+05	3.00E-01	5.15E-04	2.54E-04	1.80E-01	3.17E-03
Cs-134	8.30E+10	5.00E-10	5.15E-04	2.54E-04	4.40E-02	2.39E-07
Cs-137	1.13E+12	5.00E-10	5.15E-04	2.54E-04	3.00E-02	2.22E-06
Sr-90	7.85E+11	5.00E-10	5.15E-04	2.54E-04	1.30E+00	6.67E-05
Ru-106	7.03E+09	5.00E-10	5.15E-04	2.54E-04	4.70E-01	2.16E-07
					Total Dose	0.027

Thyroid Dose

Nuclide	DSC inventory (uCi)	Release fraction	X/Q (sec/m^3)	Breathing rate (m^3/sec)	Thyroid inhalation DCF[13] (rem/uCi)	Dose at boundary (rem)
H-3	4.30E+09	3.00E-01	5.15E-04	2.54E-04	1.20E-04	2.02E-02
Kr-85	6.60E+10	3.00E-01	5.15E-04	1.00E+00	3.34E-10 (2)	3.41E-03
I-129	4.49E+05	3.00E-01	5.15E-04	2.54E-04	8.30E+00	1.46E-01
Cs-134	8.30E+10	5.00E-10	5.15E-04	2.54E-04	7.70E-02	4.18E-07
Cs-137	1.13E+12	5.00E-10	5.15E-04	2.54E-04	4.90E-02	3.62E-06
Sr-90	7.85E+11	5.00E-10	5.15E-04	2.54E-04	9.50E-03	4.88E-07
Ru-106	7.03E+09	5.00E-10	5.15E-04	2.54E-04	6.10E-02	2.80E-08
					Thyroid Dose	0.170

(1) The distance from the controlled area boundary to the nearest HSM is about 3,700 feet.

(2) Whole-body submersion DCF in rem-m^3/uCi-sec (Reference 14).

Table 6.4 Expected dose at the nearest residence resulting from dry shielded canister leakage accident at the Oconee Nuclear Station (1)

Whole Body Dose

Nuclide	DSC inventory (uCi)	Release fraction	X/Q (sec/m³)	Breathing rate (m³/sec)	Whole body inhalation DCF[13] (rem/uCi)	Dose at residence (rem)
H-3	4.30E+09	3.00E-01	3.00E-04	2.54E-04	1.20E-04	1.18E-02
Kr-85	6.60E+10	3.00E-01	3.00E-04	N.A.	3.34E-10 (2)	1.98E-03
I-129	4.49E+05	3.00E-01	3.00E-04	2.54E-04	1.80E-01	1.85E-03
Cs-134	8.30E+10	5.00E-10	3.00E-04	2.54E-04	4.40E-02	1.39E-07
Cs-137	1.13E+12	5.00E-10	3.00E-04	2.54E-04	3.00E-02	1.29E-06
Sr-90	7.85E+11	5.00E-10	3.00E-04	2.54E-04	1.30E+00	3.89E-05
Ru-106	7.03E+09	5.00E-10	3.00E-04	2.54E-04	4.70E-01	1.26E-07
					Total Dose	0.016

Thyroid Dose

Nuclide	DSC inventory (uCi)	Release fraction	X/Q (sec/m³)	Breathing rate (m³/sec)	Thyroid inhalation DCF[13] (rem/uCi)	Dose at residence (rem)
H-3	4.30E+09	3.00E-01	3.00E-04	2.54E-04	1.20E-04	1.18E-02
Kr-85	6.60E+10	3.00E-01	3.00E-04	N.A.	3.34E-10 (2)	1.98E-03
I-129	4.49E+05	3.00E-01	3.00E-04	2.54E-04	8.30E+00	8.52E-02
Cs-134	8.30E+10	5.00E-10	3.00E-04	2.54E-04	7.70E-02	2.43E-07
Cs-137	1.13E+12	5.00E-10	3.00E-04	2.54E-04	3.30E-02	1.42E-06
Sr-90	7.85E+11	5.00E-10	3.00E-04	2.54E-04	9.50E-03	2.84E-07
Ru-106	7.03E+09	5.00E-10	3.00E-04	2.54E-04	6.10E-02	1.63E-08
					Thyroid Dose	0.099

(1) The distance from the nearest resident to the HSM containing the breached DSC is about 1 mile.

(2) Whole-body submersion DCF in rem-m³/uCi-sec (Reference 14).

After the radioactive material escapes the DSC, two factors are important in determining whether the particles reach the population: the fraction that becomes suspended in air, and the fraction that is respirable (less than 10 microns in diameter). A direction-independent atmospheric dispersion (X/Q) value was used to calculate a dose at the nearest controlled area boundary (0.74 mi. or 1.2 km), and the nearest residence (1 mi. or 1.6 km). The X/Q used is taken from Regulatory Guide 1.4,[15] and assumes Class F stability, 1 m/sec wind speed, and ground-level release.

The upper bound dose at the controlled area boundary due to the postulated accident which releases 30% of the tritium, noble gas, and iodine would be about 27 mrem to the whole-body and 170 mrem to the thyroid. The dose at the location of the nearest residence would be about 16 mrem to the whole-body and about 100 mrem to the thyroid. The resultant whole-body dose to an individual at the controlled area boundary is a small fraction of the 5 rem criteria specified in 10 CFR 72.106(b). These doses are also much less than the Protective Action Guides (PAGs) established by the Environmental Protection Agency (EPA) for individuals exposed to radiation as a result of accidents: 1 rem to the whole-body and 5 rem to the most severely affected organ. Thus, the release of effluents from the ISFSI due to accidents, even those with a very low probability of occurrence, will have a negligible impact on the population in the surroundings of the Oconee Nuclear Station.

A separate emergency planning zone (EPZ) has not been developed for the ISFSI. The 10-mile Plume Exposure Pathway EPZ for the Oconee Nuclear Station provides a sufficient level of safety for credible accident scenarios related to construction and operation of the ISFSI.

6.2.3 Nonradiological Impacts

6.2.3.1 Land Use and Terrestrial Resources

Operation of the ISFSI will not require the use of any land beyond that which was cleared and graded during its construction, and is not expected to adversely impact the terrestrial environment. Heat from the DSCs is not expected to be high enough to impact vegetation growth adjacent to the HSMs. Inhibited access to the ISFSI by the surrounding fence and the lack of nearby vegetative cover will discourage wildlife species from using the area adjacent to the HSMs. During winter months some birds may roost on the upper surface of the HSMs due to heat from the exit vents. This is not expected to result in adverse impact to individual birds. Wire mesh screens will be placed over the inlet and exit ports of the HSMs to prohibit entry of birds, wind-blown debris, etc.

There is one historical site, Old Pickens Church and Cemetery, located about 3600 feet east of the proposed ISFSI site within the exclusion area. Operation of the ISFSI would normally have no impact on this site. However, in the unlikely event of an emergency or off-normal condition, Duke Power Company has the authority to close this site to the public, as well as access to SC Highways 45, 130 and 183.

6.2.3.2 Water Use and Aquatic Resources

The Oconee ISFSI is a passive, air-cooled system. There is no planned water use or liquid discharge to local surface or groundwater supplies associated with operation of the ISFSI. Surface runoff from precipitation will enter Lake Keowee under existing drainage routes, but is not expected to result in negative impact to Lake Keowee water quality.

The only water required for operation of the ISFSI, for decontamination of the transfer cask, will be used within the confines of the Oconee Station Auxiliary Building.

6.2.3.3 Other Impacts of Operation

Climatology

During rainy days, precipitation may vaporize upon contact with the surface of the HSMs as a result of the relative higher temperature of the HSM surface or outlet air. Consequently, fog may form above the HSMs. However, a significant increase in the amount of fog extending beyond the plant's exclusion boundary is not expected.

Noise

Noise associated with operation of the ISFSI will result from transfer of the designated spent fuel from the spent fuel pool facility to the HSMs. The noise associated with this activity is not expected to be distinguishable from other operational noise at the site or to result in adverse impact to local residents.

Socioeconomics

No additional personnel will be required for operation of the ISFSI. Therefore, operation will not contribute to any socioeconomic impacts in the region.

7.0 SAFEGUARDS FOR SPENT FUEL

The Commission's requirements for the protection of an ISFSI are set forth in 10 CFR Part 72 Subpart H and include a security organization, response guards, access controls, detection aids, communications systems, and liaison with law enforcement agencies.

The applicant has submitted to the NRC a Physical Security Plan which contains commitments to these requirements. This physical security plan incorporates measures presently in effect for the protection of the Oconee operating reactors, and establishes additional safeguards specifically for the stored fuel. The combined plans assure that:

- Access to the site is controlled and limited to authorized individuals,
- Unauthorized intrusions or activities are detected in a timely manner,
- Armed responders are available to counter the threat,
- The capability to call for assistance from local police units is available,
- Explosives and contraband weapons are excluded from the site,
- The fuel storage canister is additionally protected by a reinforced concrete storage module,
- Access to the concrete storage modules is limited and controlled,
- All special equipment needed to gain access to storage canisters are secured to prevent misuse, and
- Movement onsite is under the surveillance and protection of the site's armed security force.

The implementation of these physical security plans will be inspected for effectiveness and operational compliance.

Theft or diversion of spent power reactor fuel by subnational adversaries with the intent of utilizing the contained special nuclear material (SNM) for nuclear explosives is not considered credible due to (1) the unattractive form of the contained SNM, which is not readily separable from the radioactive fission products, and (2) the immediate hazard posed by the high radiation levels.

The applicant's security plan, when implemented, will protect against a threat comparable to the design basis threat set forth in 10 CFR 73.1(a)(1). Accordingly, the storage of spent fuel at this site will not constitute an unreasonable risk to the public health and safety from radiological sabotage.

8.0 DECOMMISSIONING

All spent fuel assemblies stored in the proposed Oconee ISFSI will eventually be shipped to a DOE Monitored Retrievable Storage (MRS) Facility or directly to a Federal Geological Repository for permanent storage. Decommissioning of the ISFSI will be performed in conjunction with decommissioning of the Oconee Nuclear Station. The costs of decommissioning the ISFSI are expected to represent a small and negligible fraction of the costs of decommissioning the Oconee Nuclear Station.

Decommissioning will involve submittal of a decommissioning plan in accordance with 10 CFR 72.30[(1)]. The only activities expected in decommissioning the Oconee ISFSI are the removal of the spent fuel from the site for transfer to a Federal repository, and the decontamination and dismantling of the concrete HSMs. Presently, Duke Power Company expects to be able to remove the DSCs containing the spent fuel from the HSMs and place them in a transportation cask for shipment to the Federal repository. If the fuel must be removed from the DSCs for transport or disposal, the canister could be decontaminated and disposed of as low-level waste. The HSMs are expected to have minimal contamination of their internals and air passages, which could be easily removed. Subsequent to removal of the DSCs, the reinforced concrete modules could be broken up and removed. No residual contamination is expected to remain on the concrete pads.

Based on a separate NRC staff assessment,[16] annual occupational doses associated with unloading spent fuel from the ISFSI, after 20 years storage, for subsequent offsite shipment to a Federal MRS or repository are estimated to be small. If the DSC must be returned to the reactor buildings, and the fuel removed from the DSC, returned to the spent fuel storage pool, and loaded into a shipping cask, the occupational doses associated with storage cask and fuel handling are expected to be less than one-half of the values shown in Table 6.1. If the DSC is compatible with a certified shipping cask and easily inserted directly into the shipping cask from the HSM, doses to workers are expected to be about one-tenth of the doses shown in Table 6.1.

---

(1) Under Section 51.20(b)(10) of 10 CFR Part 51, an EIS must be prepared in connection with the issuance of a license amendment authorizing decommissioning of an ISFSI. The action proposed herein is limited to construction and operation; a request for authority to decommission, contemplated by Section 72.54 of 10 CFR Part 72, will come at a later date. Regulations revising the requirements for such applications, as well as the requirements applicable to such authorization, have recently been proposed [50 Fed. Reg. 5600 (February 11, 1985)]. Among the proposed regulatory changes is the deletion of the requirement in Section 51.20(b)(10) to prepare an EIS in connection with decommissioning of an ISFSI.

9.0 SUMMARY AND CONCLUSIONS

9.1 SUMMARY OF ENVIRONMENTAL IMPACTS

As discussed in Section 6.1, no significant construction impacts are anticipated. The activities will affect only a very small fraction of the land area of the Oconee Nuclear Station. With good construction practices, the potentials for fugitive dust, erosion and noise impacts, typical of the planned construction activities, can be controlled to insignificant levels. The only resources committed irretrievably are the steel, concrete and other construction materials used in the ISFSI storage modules, pads, and canisters.

The primary exposure pathway associated with the ISFSI operation is direct irradiation of site workers and nearby residents. As discussed in Section 6.2.1, the radiological impacts from liquid and gaseous effluents during normal operation of the ISFSI fall within the scope of impacts from licensed reactor operations, which were assessed in the Oconee FES and are controlled by the existing Technical Specification for the reactors.

The dose to the nearest resident from ISFSI operation is about 0.03 mrem/yr, and when added to that of the operations of the three-unit Oconee Nuclear Station, is much less than 25 mrem/yr as required by 10 CFR 72.104. The collective dose to residents within one to two miles of the ISFSI is about 0.007 personrem/yr. Occupational dose to site workers during HSM construction (18.8 person-rem/yr), and during ISFSI operation (12.9 person-rem/yr), is a small fraction of the total occupational dose commitment at the Oconee Nuclear Station (i.e., 1243 person-rem/yr is the annual average occupational dose over 10 years ending in 1985). Individual doses are controlled to be within the limits established by 10 CFR Part 20.

The upperbound offsite radiological impacts due to accidents at the Oconee ISFSI are about 27 mrem to the whole-body and 170 mrem to the thyroid of an individual located at the controlled area boundary, and about 16 mrem whole body and 100 mrem thyroid doses to the nearest resident. These doses are only a small fraction of the criteria specified in 10 CFR 72.106(b) and by the EPA Protective Action Guides. The Emergency Planning Zone (EPZ) for the ISFSI will coincide with that of the Oconee Nuclear Station (i.e., a 10-mile Plume Exposure Pathway and 50-mile Ingestion Pathway).

As discussed in Section 6.2.3, no significant nonradiological impacts are expected during operation of the ISFSI. The only environmental interface of the ISFSI is with the air surrounding the storage modules; the only discharge of waste to the environment is heat to the air via the passive heat dissipation system. Climatological effects which are anticipated in the immediate vicinity of the ISFSI are judged to be insignificant to public health and safety.

9.2 BASIS FOR FINDING OF NO SIGNIFICANT IMPACT

We have reviewed the proposed action relative to the requirements set forth in 10 CFR Part 51, and based on this assessment have determined that issuance of a materials license under 10 CFR Part 72 authorizing storage of spent fuel at the Oconee ISFSI will not significantly affect the quality of the human environment. Therefore, an environmental impact statement is not warranted, and pursuant to 10 CFR Part 51.31, a Finding of No Significant Impact is appropriate.

10.0 REFERENCES

1. Duke Power Company, "Independent Spent Fuel Storage Installation Environmental Report Duke Power Company Oconee Nuclear Station," March 1988.

2. Nutech, Inc., "Topical Report for the Nutech Horizontal Modular Storage System for Irradiated Nuclear Fuel NUHOMS-24P," San Jose, CA, 1988.

3. U.S. Nuclear Regulatory Commission, "Final Generic Environmental Impact Statement on Handling and Storage of Spent Light Water Power Reactor Fuel," NUREG-0575, August 1979.

4. U.S. Atomic Energy Commission, "Final Environmental Statement Related to Operation of Oconee Nuclear Station Units 1, 2 and 3," March 1972.

5. Duke Power Company, "Supplement to Environmental Quality Features of Duke Power Company's Keowee-Toxaway Project," October 1971.

6. Duke Power Company, Steam Production Department, "Oconee Nuclear" Station Environmental Summary Report 1971 - 1976," Volumes 1 and 2, November 1977.

7. Duke Power Company, Letter from H. B. Tucker to the NRC, "Independent Spent Fuel Storage Installation Environmental (ISFSI) Response to NRC Questions - Environmental Report," August 16, 1988.

8. Duke Power Company, "Oconee Nuclear Station Final Safety Analysis Report," with updates through July 1986.

9. Duke Power Company, "Independent Spent Fuel Storage Installation Safety Analysis Report Duke Power Company Oconee Nuclear Station," March 1988.

10. National Severe Storms Forecast Center, "Compilation of Tornadoes within 125 NM of Oconee County, SC, 1950 - 1987," 1988.

11. Duke Power Company, "Oconee Nuclear Station 1987 Radiological Environmental Monitoring Report," 1988.

12. Wilmot, Edwin L., "Transportation Accident Scenarios for Commercial Spent Fuel," SAND80-2124, Sandia National Laboratory Albuquerque, NM, February 1981.

13. Dunning, Donald E., "Estimate of Internal Dose Equivalent from Inhalation and Ingestion of Selected Radionuclides," WIPP-DOE-176, Evaluation Research Corporation, Oak Ridge, TN for Westinghouse Electric Corporation.

14. D. C. Kocher, "Dose Rate Conversion Factors for External Exposure to Photons and Electrons," NUREG/CR-1918, prepared for the NRC by Oak Ridge National Laboratory, Oak Ridge, TN, August 1981.

15. U.S. Nuclear Regulatory Commission, "Assumptions Used for Evaluating the Potential Radiological Consequences of a Loss of Coolant Accident for Pressurized Water Reactors," Regulatory Guide 1.4, June 1974.

16. U.S. Nuclear Regulatory Commission, Note to File, "Comparative Analysis Examining Two Storage Systems," October 20, 1988, Docket No. 72-4.

11.0 LIST OF AGENCIES AND PREPARERS

Those NRC staff members principally responsible for the preparation of this EA are listed below:

Name	Responsibility
John P. Roberts	Project Leader
Frederick C. Sturz	Project Manager

The following outside agencies were contacted for supporting documentation. Their support is appreciated.

Anderson County Planning Commission

Appalachian Council of Governments

National Severe Storms Forecast Center

Oak Ridge National Laboratory

Oconee County Planning Commission

Pickens County Planning Commission