U.S. NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS

ENVIRONMENTAL ASSESSMENT RELATED TO THE CONSTRUCTION AND OPERATION OF THE H. B. ROBINSON INDEPENDENT SPENT FUEL STORAGE INSTALLATION

DOCKET NO. 72-3 (50-261)
CAROLINA POWER AND LIGHT COMPANY

MARCH 1986

CONTENTS

CONTENTS (Continued)

ENVIRONMENTAL ASSESSMENT

RELATED TO THE PROPOSED CONSTRUCTION AND OPERATION

OF THE H. B. ROBINSON INDEPENDENT

SPENT FUEL STORAGE INSTALLATION

1.0 INTRODUCTION

1.1 DESCRIPTION OF THE PROPOSED ACTION

By letter dated February 4, 1985, Carolina Power and Light Company (CP&L or the Applicant) submitted an application for a license to construct and operate a Dry Storage Independent Spent Fuel Storage Installation (ISFSI) to be located on the H. B. Robinson Steam Electric Plant site in Darlington County, South Carolina. Carolina Power and Light Company owns and operates a 769 MWe nuclear generating unit (Unit 2) and a 185 MWe fossil-fueled generating unit (Unit 1) on the Robinson site. The ISFSI will be located within the Unit 2 protected area* approximately 600 ft west of the containment building.

The Robinson ISFSI is designed to operate for 50 years, well beyond the operating life of Unit 2. However, licenses issued under 10 CFR Part 72 are for 20 years. The licensee may seek to renew the license, if necessary, prior to its expiration. The ISFSI provides for the horizontal, dry storage of irradiated fuel assemblies in a concrete module.

---

*"protected area" means an area encompassed by physical barriers and to which access is controlled.

This Environmental Assessment addresses the potential environmental impacts associated with the proposed construction and operation of the Dry Storage ISFSI on the H. B. Robinson Steam Electric Plant site.

1.2 BACKGROUND INFORMATION

The H. B. Robinson Nuclear Steam Electric Plant (HBR 2) was licensed to operate at low power (5 MWt) on July 31, 1970 (Facility Operating License No. DPR-23) and at 2200 MWt on September 30, 1970.[1] Commercial operation began in March 1971.

Prior to the mid 1970's, the nuclear industry planned to store, for an interim period, spent fuel from nuclear-powered reactors in a spent fuel pool at the reactor site where 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 H. B. Robinson Unit 2, 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 on spent fuel storage. The Commission directed the staff to analyze alternatives for the handling and storage of spent fuel from light water 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 on Handling and Storage of Spent Light Water Reactor Fuel, NUREG-0575, (the FGEIS),[2] was issued by the 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 is implemented.

Interim storage options evaluated in detail and included in the FGEIS were: (1) onsite expansion of spent fuel pool capacity, (2) expansion of spent fuel pool storage capacity at reprocessing plants, (3) use of independent spent fuel storage facilities, (4) transshipment of spent fuel between reactors and (5) reactor shutdowns to terminate or reduce amount of spent fuel generated. Of these options, 115 onsite spent fuel pool capacity expansions through reracking modifications have been reviewed and approved by the NRC since issuance of the FGEIS. Spent fuel pool capacity has been increased to its maximum through reracking at HBR 2. Structural support limitations preclude further expansion, in the pool, thus eliminating this as a viable option for meeting increased storage needs. Transshipment as a storage option has been used between HBR 2 and the Brunswick Nuclear Generating Station. H. B. Robinson spent fuel storage capacity at the Brunswick station has now been filled. Carolina Power and Light Company can consider transshipment of spent fuel to the Shearon Harris Nuclear Power Plant, when it begins commercial operation.

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 LWR 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.[2] In the case of both dry passive storage and wet storage, environmental impacts would need to be considered on a site-specific basis. This assessment addresses the site-specific environmental impacts from construction and operation of the dry storage ISFSI at the H. B. Robinson site.

In connection with its license application, Carolina Power and Light Company (CP&L) has entered into an agreement with the U.S. Department of Energy (DOE) to conduct a dry storage demonstration program for spent nuclear fuel at HBR 2 during the first year of the ISFSI operation.[3] The Electric Power Research Institute (EPRI) will also participate in the demonstration program. While the demonstration calls for installation of three horizontal concrete storage modules, the CP&L license application is for a total of eight modules.

1.3 PREVIOUS ENVIRONMENTAL ASSESSMENTS AND SUPPORTING DOCUMENTS

Two environmental documents have been prepared which are specific to the H. B. Robinson site. An environmental report related to the operation of HBR 2 was submitted by CP&L in November 1971. A Final Environmental Statement (FES) related to operation of HBR 2 was published by NRC in April 1975.[1]

This Environmental Assessment is tiered on the 1975 FES and on the Final Generic Environmental Impact Statement (NUREG-0575) noted in Section 1.2 above.

Additional information used in this assessment is provided in the applicant's H. B. Robinson ISFSI Environmental Report (ER)[4] and Safety Analysis Report (SAR).[5]

2.0 NEED FOR PROPOSED ACTION

The proposed action will serve two purposes. The Nuclear Waste Policy Act (NWPA) of 1982 requires DOE to, "establish a demonstration program in cooperation with the private sector, for the dry storage of spent nuclear fuel at civilian nuclear power reactor sites, with the objective of establishing one or more technologies that the Commission [NRC] may by rule approve for use at the sites of civilian nuclear power reactors without, to the maximum extent practicable, the need for additional site-specific approvals by the Commission." The initial year of the ISFSI operation will serve as a demonstration program called for by the NWPA. The results from the demonstration program will provide valuable information to the nuclear utility industry. The second purpose is to provide additional spent fuel storage at the H. B. Robinson site.

The H. B. Robinson spent fuel pool has a capacity of 544 PWR assemblies. Presently there are 222 assemblies stored in the pool. The H. B. Robinson Unit 2 reactor core capacity is 157 assemblies.[1] This leaves space to store 166 more assemblies without infringing on full core reserve storage capacity. Because the plant discharges 44 assemblies per cycle, there is only room for three more fuel cycle discharges. Thus, CP&L could loose full core reserve capacity in the H. B. Robinson spent fuel pool as early as after the 1988 refueling outage. The proposed dry storage ISFSI will provide capacity for 56 fuel assemblies, a little more than the storage increment required following a typical refueling outage. Thus, this action will provide some needed additional spent fuel storage at the H. B. Robinson site. The ISFSI demonstration itself will not fill the need for further additional storage of H. B. Robinson spent fuel which is expected to arise during the remaining life of the station. However, it will provide a basis of experience for consideration in further planning for additional storage capacity.

3.0 ALTERNATIVES

The following sections include a discussion of alternatives to the proposed action. The alternatives were considered against the need for the proposed action discussed in Section 2.0. Alternatives were considered both from the standpoint of the ISFSI demonstration and provision of additional spent fuel storage capacity.

The preferred alternative is to ship spent fuel to a permanent federal repository for disposal. The Department of Energy is currently working to develop a repository as required under the NWPA but is not likely to have a licensed repository ready to receive spent fuel before 1998. Therefore, this alternative does not meet the near-term storage needs of the Carolina Power & Light Company.

As previously discussed in Section 1.2, CP&L has reracked the spent fuel pool at H. B. Robinson Unit 2 to its maximum structural capacity and has transshipped 304 spent fuel assemblies from H. B. Robinson to its Brunswick Nuclear Generation Station spent fuel pools. Although transshipment to its Brunswick station is no longer available, CP&L can still consider transshipment to its Shearon Harris Nuclear Power Plant spent fuel pools as an alternative to meeting its near-term spent fuel storage needs at H. B. Robinson Unit 2. However, this alternative is not viable until the Shearon Harris plant gets an operating license which is expected later this year. Additionally, transshipment would not assist in the demonstration of dry storage of spent fuel, as contemplated by the NWPA.

Additional pool storage onsite for the limited amount of fuel (56 assemblies) proposed for this action would be a more costly alternative than dry storage because it would require construction of an entirely independent storage pool facility. Also, additional onsite pool storage capacity expansion would not provide a demonstration of dry storage of spent fuel as contemplated by the NWPA. Within the limited scope of this proposed action, this alternative is not viable. However, in the future, additional onsite independent spent fuel pool storage could be a viable alternative for meeting CP&L's near-term spent fuel storage needs.

Dry cask storage of spent fuel at the H. B. Robinson site is an alternative that could readily provide additional storage for the limited amount of fuel proposed for this action. However, the DOE, under the NWPA, already has entered into a cooperative agreement with Virginia Electric and Power Company to demonstrate dry cask spent fuel storage technology. Thus, for the DOE to enter into a second dry cask spent fuel storage demonstration would do little to further the NWPA objective of demonstrating dry storage technologies. In the future, perhaps, dry cask storage could be an alternative for meeting CP&L's additional storage needs.

4.0 ENVIRONMENTAL INTERFACES

Environmental features which the staff believes most likely to be affected by the construction and operation of the H. B. Robinson ISFSI are summarized in this section. Most environmental impacts are expected to be limited to the H. B. Robinson site. For two of the potential impacts (i.e., socio-economics and radiological dose to humans) the staff considered the region of interest to extend out to an 80 km (50 mi) radius from the site. The staff's assessment of construction and operational impacts are presented in Chapter 6.

4.1 SITE LOCATION, LAND USE AND TERRESTRIAL RESOURCES

The H. B. Robinson site is located in northwest Darlington County, South Carolina, approximately 3 miles (4.8 km) WNW and 24 miles (38.6 km) NW of the towns of Hartsville and Florence, South Carolina, respectively. The site is located in the Coastal Plain Physiographic Province, on the southwest shore of Lake Robinson, a 2200 acre (890.7 ha) impoundment of Black Creek.

The land within a five-mile radius of the site is covered with an irregular patchwork of pine forest stands and open fields. Immediately adjacent to the north and west boundary of the HBR 2 complex is pine forest. The western shore of Lake Robinson is nearly completely forested north of the site. A more detailed description of the site location and environmental resources in the immediate site vicinity is provided in the FES,[1] the ISFSI, SAR,[5] and the H. B. Robinson Final Safety Analysis Report.[6]

4.2 WATER USE AND AQUATIC RESOURCES

The lake is used by the applicant for cooling at the HBR 2 nuclear power plant (Unit 2) and at the coal-fired unit (Unit 1). At the site, the lake is at a maximum water elevation of 222 ft (67.7 m) MSL. Downstream of the dam for Lake Robinson, near the town of Hartsville, is a smaller impoundment called Prestwood Lake used primarily by a paper manufacturing company.[4] Detailed information on fish species and other aquatic species of Lake Robinson is provided in the FES.[1]

4.3 SOCIOECONOMICS AND HISTORICAL, ARCHEOLOGICAL AND CULTURAL RESOURCES

The immediate area surrounding the H. B. Robinson site is rural. The site however is within commuting distance of Florence, Camden and Darlington. Columbia, the nearest large city, is located approximately 55 mi (88.6 km) SW of the site. No known archeological or historic sites remain at the H. B. Robinson site.[1] A description of historic sites is provided in the FES.[1]

4.4 DEMOGRAPHY

Based on data provided by the applicant,[6] residential population within five miles of the H. B. Robinson site for 1980 was estimated at 11,124 persons or 142 persons per square mile. Population estimates at various distance intervals and years are provided in Table 4.2. The nearest residence is approximately 1400 ft (42.7 m) south of the proposed ISFSI complex. Detailed population data are presented in Section 2.1.3 of the H. B. Robinson Final Safety Analysis Report (FSAR).[6]

4.5 METEOROLOGY

The H. B. Robinson site lies in the Coastal Plain of South Carolina. Climatology of South Carolina depends largely on elevation, distance from the Atlantic Ocean and Appalachian mountain chain. At an elevation of 225 ft msl and a distance of 160 mi (257.6 km) from the Appalachian mountains the site has a temperate climate. More detailed information on climatology is contained in the ISFSI SAR[5] and the H. B. Robinson FSAR.[6]

Local meteorology is based on data from 1976-1981 collected at the HBR 2 site and offsite data from Florence, SC; Columbia, SC; Charlotte, NC; Greensboro, NC; and Raleigh-Durham, NC. Onsite lower level (12.5 m) average wind speed is 5.2 mph. The maximum site-area one-minute average wind speed of 60 mph was recorded in March 1954. Wind intensities and precipitation amounts onsite are no greater during hurricanes than those produced during severe thunderstorms. Wind direction and speed data collected for Florence, SC, indicate that winds are predominantly from a NNE and SSW direction at average wind speeds ranging from 6.9 to 7.9 mph.

Table 4.1 Estimated Residential Population and Population Projection Between 0 and 50 Miles of the H. B. Robinson Site

	Year			
Distance (mi)	1980	1986	1990	2000
0-5	11,124	12,242	12,079	14,546
5-10	19,920	21,832	23,275	25,675
10-50	646,993	702,669	747,387	832,854

Mean precipitation amounts by month for the site region are not highly variable to result in a typically "wet" or "dry" season during the year. Average precipitation ranges from 42.5 to 46.4 inches per year.

Onsite meteorological data have been obtained from 1976-1981 at the tower located approximately 0.5 mi N of the HBR Unit 2 containment. Detailed meteorological data are provided in the H. B. Robinson FSAR.[6]

4.6 GEOLOGY AND SEISMOLOGY

The H. B. Robinson site is located in the Coastal Plain Physiographic Province approximately 15 mi (24.2 km) SE of the Piedmont Province. In South Carolina the Coastal Plain is composed of largely unconsolidated sediments which overlie a slightly sloping surface of crystalline rock. Coastal Plain sediments in the site vicinity are known as the Middendorf Formation. The Middendorf Formation is about 400 ft (121.9 m) thick and overlies a slightly sloping surface of Piedmont crystallines that may be weathered near the surface. Surficial materials at the site are recent soils having a high quartz content. Between the surface and the Middendorf Formation are sediments approximately 30 ft (9.1 m) thick consisting of alluvial material.

A study of the possibility of existence of faults in the site area indicated that no active faulting was apparent. No faulting is apparent in the unconsolidated sediments of the Coastal Plain.[5] However, some faulting in the basement complex is known from exposures above the Fall Zone and cores from scattered borings drilled through Coastal Plain sediments.

Test borings at the ISFSI site indicated a potential for liquefaction. The borings showed a 5 ft (1.5 m) thick sand lens at a depth of approximately 100 ft (30.5 m). However, the lens is surrounded by hard silty clay and dense sand and is not likely to be affected by a design basis earthquake.

The largest earthquake in the region occurred at Charleston, South Carolina, (approximately 120 mi from the site) in 1886 having a shock intensity of about Modified Mercali IX at the epicenter with epicental acceleration of 0.25 g to 0.30 g.[5] Only one earthquake of intensity V or greater has been recorded within 50 mi (80.5 km) of the H. B. Robinson site. This shock occurred in 1959 near McBee, South Carolina, with an intensity of VI. The epicenter was located about 15 mi (24.2 km) from the site. There is no trend of epicenters in the entire region except those paralleling the Blue Ridge Mountains in western South Carolina. Based on historical data it seems apparent that the site will not experience damaging earthquake motion during the life of the ISFSI.

5.0 DESCRIPTION OF H. B. Robinson ISFSI

5.1 GENERAL DESCRIPTION

The ISFSI provides for the horizontal, dry storage of irradiated fuel assemblies in a concrete module. The principal components are a concrete horizontal storage module (HSM) and a steel dry-shielded canister (DSC) with an internal basket which holds the fuel assemblies.

Each HSM contains one DSC, and each DSC contains seven fuel assemblies. The demonstration program will consist of three storage modules occupying a common concrete foundation. Five additional modules will be constructed on a second foundation located adjacent to the first foundation. The eight storage modules will occupy a surface area of 0.15 acres located approximately 600 ft (182.9 m) west of the containment building within the H. B. Robinson Unit 2 protected area.

The ISFSI will require transfer equipment to move the DSC's from the spent fuel pool to the HSM's. The transfer system consists of a modified General Electric (GE) IF-300 transportation cask, a hydraulic ram, a truck, a trailer and a cask skid (Figures 5.1, 5.2).

5.2 ISFSI DESIGN

The design parameters for the ISFSI are shown in Table 5.1. Structural features of the DSC are designed to withstand a specific cask drop accident.

Table 5.1 Design Parameters for the HBR ISFSI

Category	Criterion or Parameter	Value
Fuel Acceptance Criteria	Fissile Content	3.5% Fissile (U-235 Equivalent)
	Radiation Source	
	Gamma	5.73×10^{15} photons/sec/assembly[1]
	Neutron	1.67×10^{8} neutron/sec/assembly
	Heat Load	1 Kw/Assembly
Dry Shielded Canister	Capacity per Canister	7 PWR Fuel Assemblies
	Size	
	Length (typical)	4.55m (179 in)
	Diameter	0.94m (37 in)
	Temperature (max. fuel rod clad)	380°C (716°F)
	Cooling	Natural Convection
	Design Life	50 Years[2]
	Material	304 Stainless Steel with Lead End-Shields
	Internal Helium	0.981 bar (1 atm)
Horizontal Storage Module	Capacity	1 Dry Shielded Canister per Module
	Size	
	Length	5.92m (19.42 ft)
	Height	3.66m (12.00 ft)
	Width	1.70m (5.58 ft)
	Average Surface Radiation Dose Rate (area weighted average)	20 mrem/hr
	Material	Reinforced Concrete
	Design Life	50 years[2]

[1]Actual design limits are for seven assemblies in the DSC with source rates of 1.17×10^{9} neutrons/sec/DSC and 4.01×10^{16} photons/sec/DSC.
[2]Expected life is much longer; however, initial license application is for 20 years only. Future amendments may seek to extend the life.

The canister body, double containment welds on each end, and the DSC intervals are designed to provide specified safety functions after a vertical drop of 8 ft (2.4 m).

Decay heat of the spent fuel will be removed by natural draft convection. Air enters the lower part of the HSM, rises around the DSC and exits through vents in the top shielding slab (Figure 5.2). The flow cross-sectional area is designed to provide adequate cooling of the DSC's for the hottest day conditions [i.e., air inlet temperature 51.7°C (125°F) which results in an outlet temperature of 98.9°C (210°F)].

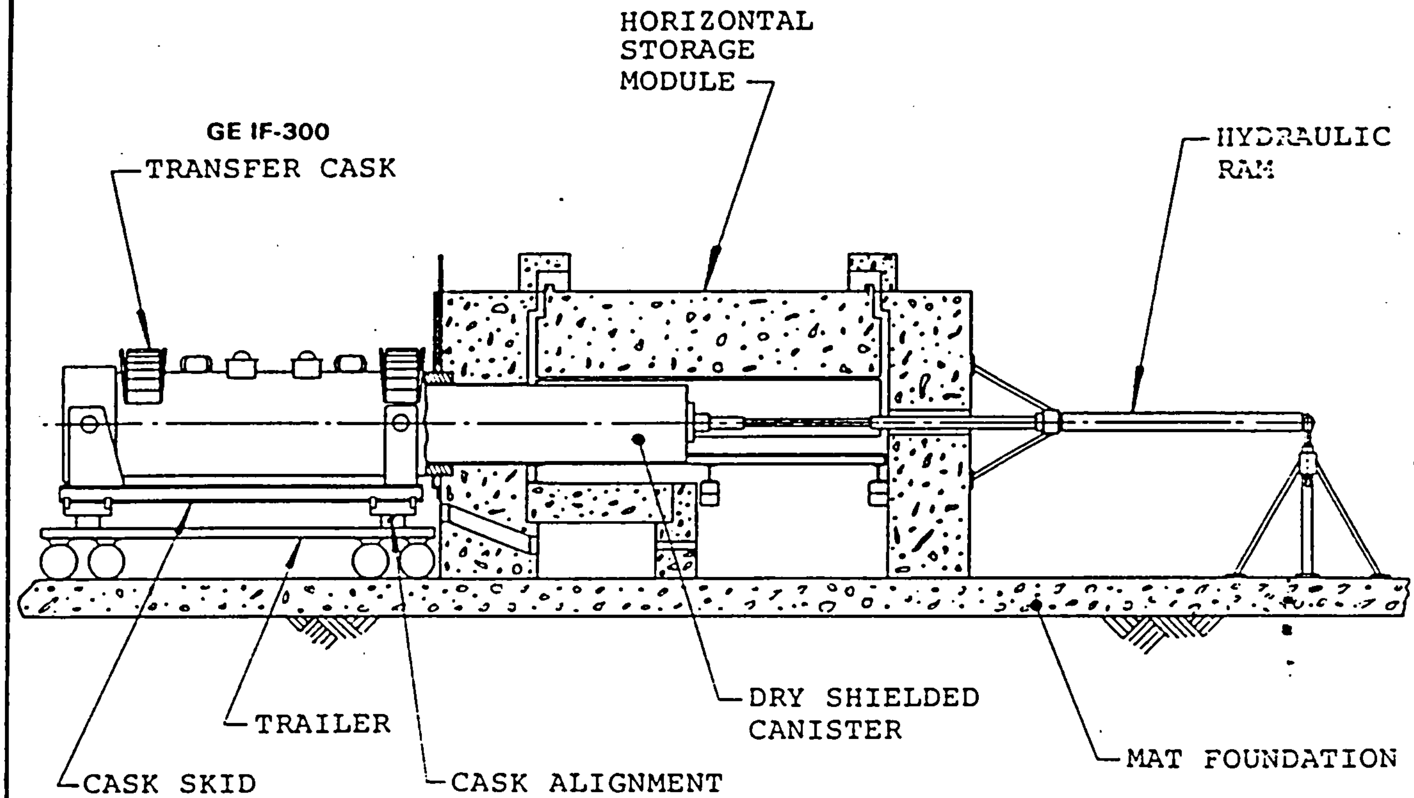
The major operating systems of the ISFSI are those required for fuel handling and transport of the fuel assemblies from the spent fuel pool to the ISFSI. The majority of the fuel handling operations involving the DSC and the IF 300 spent fuel shipping cask (i.e., fuel loading, drying, trailer loading, etc.) utilize standard procedures at the H. B. Robinson Unit 2 station for spent fuel shipment. The DSC transfer and DSC alignment with the horizontal storage module are unique to the ISFSI. Design parameters for the ISFSI operating systems and the sequence of steps in fuel handling are provided in Tables 5.2 and 5.3, respectively.

Table 5.2 Summary of ISFSI Fuel Handling Operations

1. Clean the DSC and Load it into the Transfer Cask
2. Fill the DSC and Cask with Demineralized Water
3. Lift the Cask Containing the DSC into the Spent Fuel Pool
4. Load the Fuel into the DSC
5. Place the Top Lead Plug on the DSC
6. Place the Lid on the Cask
7. Lift the Cask Containing the Filled DSC out of the Spent Fuel Pool and Place it on the Drying Pad
8. Remove the Cask Lid
9. Drain the Water from the Cask and DSC
10. Seal Weld the Upper Steel Cover of the Top Lead Plug onto the DSC Body
11. Evacuate and Dry the DSC
12. Backfill the DSC with Helium
13. Seal Weld Plugs in the Drain and Vent Line of the DSC
14. Place and Seal Weld the Top Cover Plate
15. Replace the Cask Lid
16. Lift the Cask onto the Trailer and Lower it into the Horizontal Position
17. Tow the Trailer to the HSM
18. Remove the HSM Front Access Cover
19. Remove the Cask Lid
20. Align the Cask and the HSM
21. Insert the Hydraulic Ram
22. Pull the DSC into the HSM
23. Replace and Tack Weld the HSM Front Access Cover
24. Install and Grout the Rear Access Concrete Plug

Table 5.3 Primary Design Parameters for the ISFSI Operating Systems

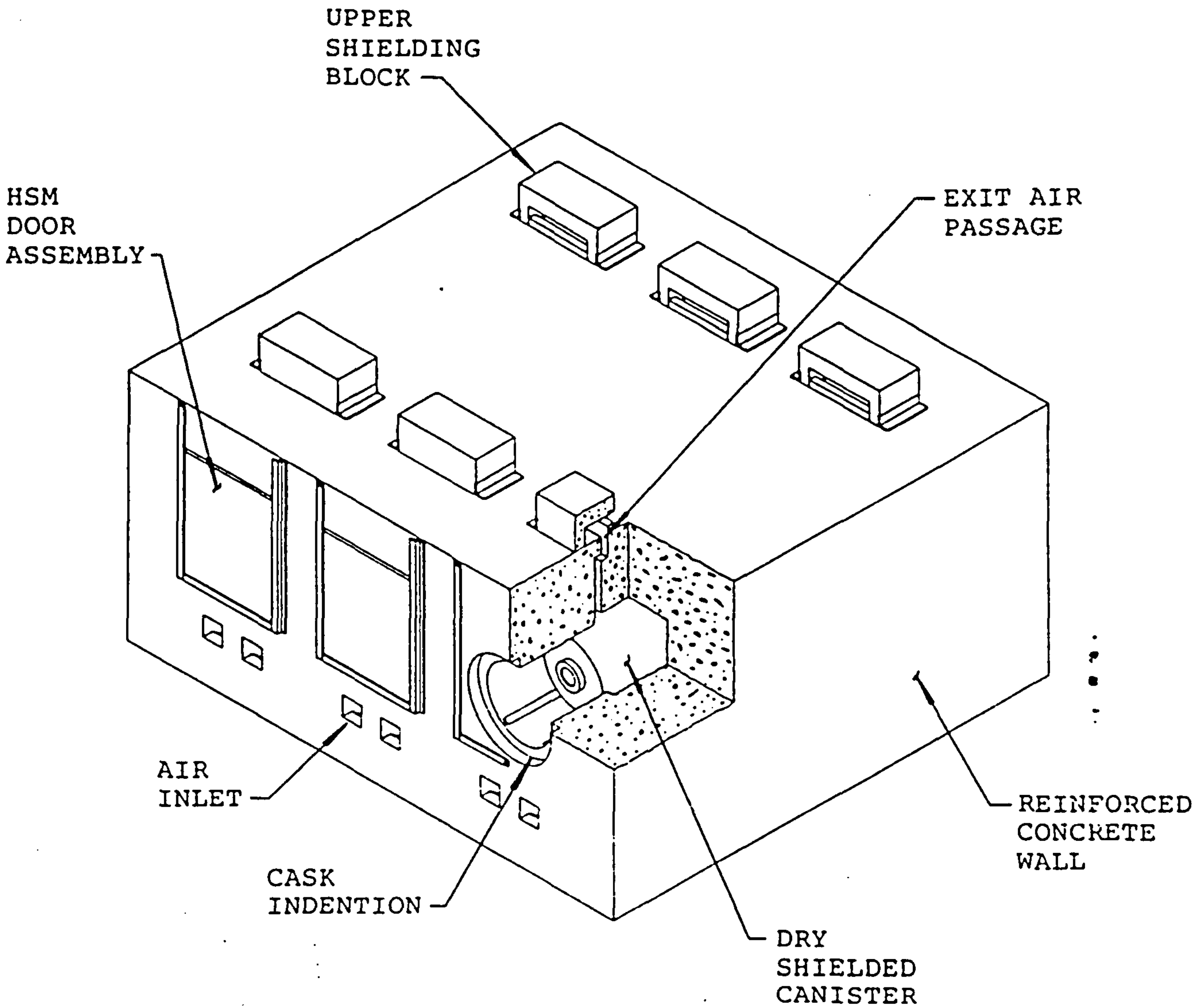
System	Parameters	Value
Cask	Cavity Diameter	0.953m (37.5 in.)
	Cavity Length	4.572m (180 in.)
	Payload Capacity	9524 kg (21,000 lb)
	Heat Rating	≥ 7Kw
	Shielding (Surface Dose)	200 mrem/hr
Cask Movement	Liftable by Crane	-
	Rotatable by Crane from Vertical to Horizontal	-
Cask Lid	Removable in Horizontal Position	-
Trailer and Skid	Truck Transportable	
	Cask Lid Must Protrude Past End of Trailer and Skid	15.25cm (6 in.)
	Capacity (Trailer)	109,000kg (120 tons)
	(Skid)	100,000kg (110 tons)
	Positioning Capability	±7.62cm (3 in.) Vertically ±5.08cm (2 in.) Towards Module ±5.08cm (2 in.) Parallel to Module



H. B. ROBINSON
INDEPENDENT SPENT FUEL
STORAGE INSTALLATION
SAFETY ANALYSIS REPORT

PRIMARY COMPONENTS OF THE ISFSI

FIGURE 5.1



H. B. ROBINSON
INDEPENDENT SPENT FUEL
STORAGE INSTALLATION
SAFETY ANALYSIS REPORT

HORIZONTAL STORAGE MODULES
FIGURE 5.2

6.0 ENVIRONMENTAL IMPACTS OF PROPOSED ACTION

6.1 CONSTRUCTION IMPACTS

6.1.1 Land Use and Terrestrial Resources

The eight storage modules will occupy a 0.15 ac area located approximately 600 ft (183 m) west of the containment building. The area is totally within the HBR 2 protected area, thus no additional land use impacts will result from construction of the ISFSI. The area to be disturbed is barren of vegetation and is located immediately adjacent to the rail spur leading from the containment building for HBR 2.

A red-cockaded woodpecker (Dendrocopos borealis) colony inhabits a pine forest stand approximately 0.5 - 1.0 mi north of the HBR 2 protected area. Construction activities will not disturb any forested areas or other habitat used by red-cockaded woodpeckers in the area. No other federally or state endangered species are expected to be impacted by construction of the ISFSI.

6.1.2 Water Use and Aquatic Resources

Construction of the ISFSI is not expected to impact local water users, water quality or aquatic biota. Erosion from excavated material or top-soil during site preparation will be contained within the immediate vicinity. The area for the ISFSI is level terrain and nearly totally surrounded to the east by buildings in the HBR 2 complex. Thus, no erosion runoff into Lake Robinson is expected during ISFSI construction. No dewatering during excavation is anticipated. Concrete for the foundations and walls of the HSM's will be pre-mixed, thus no water use nor wastes from concrete batch operations will result.

During construction for the storage modules, loading of spent fuel into the canisters, and placement of the canisters into the storage module, water will be supplied from existing HBR 2 sources. All waste water generated in the HBR 2 spent fuel pool area during loading of spent fuel into each canister will be handled under existing HBR 2 procedures for preparing spent fuel for shipments.

6.1.3 Other Impacts of Construction

No clearing of additional land or open burning of tree branches will be required because the ISFSI facility will occupy an existing cleared area within the HBR 2 protected area. Consequently little dust or combustion particulates will be generated during construction. Any spoil resulting from excavation for the HSM foundations will be deposited on plant property in a manner not to impact the environment.[4] Appropriate measures will be taken to prevent erosion from placement of excavated material.

Noise levels due to construction traffic, grading, and excavation equipment are expected to be negligible to nearby residents given the low population density in the area. Anticipated noise generated by ISFSI construction is expected to be no greater than construction noise from steam generator replacement during 1984. No objections of noise levels during this activity were reported by local residents.[4] To protect personnel located on site, Occupational Safety and Health Administration standards will be followed.

Construction of the ISFSI is anticipated to utilize the existing construction work force. Permanent office building space, other buildings and new onsite roads are currently under construction at the HBR 2 site. The ISFSI construction will require fewer workers than required for replacement of the HBR 2 steam generators in 1984, when the peak work force was estimated at 1,000. No additional community impacts are anticipated since most workers currently reside within commuting distance of the HBR 2 station.

6.1.4 Socioeconomics

The socioeconomic effects associated with construction of the facility will be essentially nil as no additional construction work force will be required.

6.2 OPERATIONAL IMPACTS

6.2.1 Radiological Impacts from Routine Operations

There are three pathways by which workers and members of the public may be exposed as a result of Independent Spent Fuel Storage Installation (ISFSI) operations: to direct radiation; to radioactivity released in gaseous effluents; and to radioactivity released in liquid effluents. Because the proposed ISFSI involves only dry storage of spent nuclear fuel in dry shielded canisters (DSC), there will be essentially no liquid or gaseous effluents associated with storage activities. Although activities associated with cask loading and decontamination may result in some liquid and gaseous effluents, these operations will be conducted at the HBR 2 under the 10 CFR Part 50 operating license. The radiological impacts from those effluents fall within the scope of impacts from reactor operations which were assessed in the HBR 2 Final Environmental Statement (FES).[1]

The primary exposure pathway associated with normal HBR ISFSI operations is direct irradiation of nearby residents and site workers. The radiological dose estimates presented were calculated using conservative and design basis assumptions: maximum storage module surface dose rates of 31 mrem/hr neutron and 81 mrem/hr gamma, maximum fuel burnup of 33 GWD/MTU, fuel out of the reactor at least 5 years before storage, and emplacement of five DSC's per year. These assumptions result in conservative dose estimates; actual doses are expected to be lower.

6.2.1.1 Offsite Dose Commitments

ISFSI operations will result in additional dose to members of the public from direct radiation exposure. Section 72.67(a) of 10 CFR 72 requires that, from normal operations, dose equivalents to any real individual located beyond the ISFSI controlled area not exceed 25 mrem/yr to the whole body as a result of planned effluents releases, direct radiation and other radiation from 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 due to liquid effluents and 5 mrem due to gaseous effluents. Thus, the maximum design guide dose commitment from effluents due to HBR Unit 2 operations would be 8 mrem/yr. Doses due to release of radioactivity in effluents are less than the design amount. The estimated maximum radiological doses due to HBR Unit 2 operations are about 0.5 mrem/yr from gaseous effluents and about 1.9 mrem/yr from liquid effluents.[1] Actual doses for 1983 were much less; 1.7E-2 mrem/yr from gaseous effluents and 5E-5 mrem/yr from liquid effluents.[7]

The design of the storage system (DSC and HSM) is such that the dose rate at the surface of the door to an HSM is higher than other side surfaces. This results in significantly higher dose rates (due to direct radiation) to the front of the HSM's (south) than in any other direction. The nearest residential location is in the southerly direction. However, buildings, trees and hilly terrain between the ISFSI and this location provide shielding, such that individuals here would essentially be exposed only to air-scattered radiation from the ISFSI.

The estimated annual dose commitment to the nearest real individual [located 487 m (0.3 mi.) away] due to air-scattered radiation from the eight modules at the HBR ISFSI is estimated to be about 0.4 mrem/yr. This dose is a fraction of the design guide dose commitment and those estimated in the FES for the HBR operations. 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 72.67 and 40 CFR 190.

There are approximately 500 residents located within 1.69 km (1 mi) of the HBR ISFSI, most at distances greater than 0.8 km (0.5 mi). The collective dose commitment to this group due to HBR ISFSI operations is estimated to be about 9E-3 man-rem/yr. The collective dose commitment due to HBR Unit 2 reactor operations to this same population, based on estimates from the HBR-FES[1], would be about 0.01 man-rem/yr. Because of attenuation, direct and air-scattered radiation from the ISFSI beyond one mile contributes little to the collective dose commitment for more distant populations in the region under consideration. Compared to the estimated 3.5 man-rem/yr due to HBR Unit 2 operations,[1] the impact of the collective dose commitment in the region due to the HBR ISFSI is negligible.

6.2.1.2 Collective Occupational Dose Commitment

Spent fuel storage at the HBR ISFSI will result in a small increase in the total occupational dose at the HBR. Engineered features of the storage modules and application of administrative controls are designed to assure that all exposures are maintained at levels which are as low as reasonably achievable (ALARA).

CP&L has estimated the maximum annual collective occupational dose commitment from the operation of the HBR ISFSI. The estimates presented here for loading and transfer operations are based on emplacing a maximum of five DSC's per year. Occupational doses during construction assumes 2400 man-hours to complete the five additional concrete storage modules to be placed adjacent to the original three modules. The exposures during construction include contributions from the previously filled modules. The additional exposure to all workers at HBR Unit 2 site, during the storage only phase, assumes the ISFSI is full.

Table 6.1 summarizes the maximum collective occupational dose commitments from annual operations and construction. The maximum of about 27 man-rem/yr dose from normal operations and 0.1 man-rem/yr for additional module construction constitutes a fraction of the total occupational dose commitment at the Station. For example, in 1983, the collective occupational dose at HBR was 923 man-rem[8]. The annual average collective occupational dose over 10 years, ending with 1983, was 1007 man-rem/yr[8]. Once all eight modules are loaded, the annual occupational dose commitment would drop to about half the maximum, to about 13.6 man-rem/yr. Individual doses are controlled to be within the limits of 10 CFR Part 20.

6.2.2.3 Radiological Impacts of Accidents

CP&L, in its application, postulated a variety of accidents and their causes at the HBR ISFSI: earthquakes, tornadoes, lightning, fires, pressurization of

Table 6.1 Collective Occupational Dose Commitments

Operation	Man-Rem/DSC	Man-Rem/8-DSC's	Man-Rem/yr
DSC loading and cask decontamination at reactor	2.4	19.0	12[a]
Transfer to and Emplacement at ISFSI	0.26	2.1	1.3[a]
Surveillance and Maintenance	-	-	1.6[b]
Construction of Five Additional Modules	-	-	0.1[c]
Additional exposure to workers at the H. B. Robinson Steam Electric Station	-	-	12[b]

[a]Five canisters per year.
[b]Assumes the ISFSI is completely filled.
[c]Assumes the initial 3 HSM's are filled.

the DSC, blockage of air inlets and outlets, dropped cask, leakage of the DSC, and loss of air outlet shielding. The canisters and storage modules are designed to withstand the resultant forces of these accidents. Two of the postulated accidents have possible offsite radiological consequences. These two are; loss of air outlet shielding and canister leakage. Of the two, canister leakage is the bounding case accident. For assessment purposes, the applicant postulated an accident scenario where a nonmechanistic simultaneous failure of the dry storage canister (DSC) and all fuel cladding occurs, resulting in the loss of the helium cover gas and 25 percent of the radioactive noble gas inventory in the spent fuel for one DSC.

The spent fuel in DSC is transported onsite from the reactor fuel handling building to the ISFSI within the cavity of a GE IF-300 shipping cask. The IF-300 cask was designed for storage and transportation of irradiated spent fuel assemblies. Although storage of spent fuel in the canister is the only use evaluated in this report, a hypothetical worst-case accident based on transportation accident scenarios is evaluated to establish an upper bound accident impact for storage applications. The transportation accident scenario is not considered credible for storage situations. It has been chosen merely to determine estimates for release of radionuclides from the spent fuel to the canister cavity and then to the environment rather than arbitrarily assuming a nonmechanistic accident release.

The release fractions used in this analysis were based on Reference E for scenario 5 (a worst-case for air-cooled casks). This scenario considers all release mechanisms that are credible for air-cooled casks. The mechanism for release of radioactivity considered appropriate for this evaluation was an impact rupture which somehow causes mechanical disruption of the cladding and subsequent depressurization of 10 percent of the fuel rods. The fraction (20 percent) of the spent fuel inventory of noble gases generated in the reactor that are in the fuel pellet gap is released to the cask cavity. Because of the low temperatures, the remainder of fission products released are assumed to be particulates that are swept out of the rods as they depressurize after rupture. The spent fuel inventory fraction that is swept out as particulates is 2E-6.

Once radionuclides have been released from the fuel rods they must then find a path out of the cask. The result of accident damage is not expected to provide a pathway with a large cross-sectional area from the cask cavity to the environment. Only a small section of a failed cask seal would be the most likely release pathway. Before the radionuclides are released to the environment, they must pass many places that are relatively cool and through small passages. As a result, radionuclides can condense, plate out, or be filtered out before escaping the cask. For gas-cooled casks (in this case helium cooled) 60 percent of the noble gases in the cask cavity are assumed to be released and 5 percent of the particulates.

After the radioactive material escapes the cask, there are two factors important in determining whether the particles reach people; the fraction that becomes suspended in air and the fraction that is respirable (less than 10 microns aerodynamic diameter). Five percent of the particulates were assumed to be smaller than 10 microns and remain as an aerosol.

The radioactivity released to the cask cavity is based on the design fuel to be stored in the cask; PWR fuel, initial enrichment of 3.5 percent U-235, 35,000 MWD/MTU burnup, 5 years out of the reactor. The 0.5 percent (F Stability, 1 m/sec wind speed) ground level direction independent atmospheric dispersion (X/Q) value was used to calculate a dose at the nearest controlled area boundary (700 ft west) and the nearest resident (1600 ft south).

Table 6.2 Radiological Doses at the Controlled Area Boundary from Storage Due to a Dry Shielded Canister Accident at the H. B. Robinson Steam Electric Plant

Nuclide	Cask Inventory[1] (μCi)	Total Fraction Released Aerosolized + Respirable[2]	X/Q[3] (sec/m^3)	Breathing Rate[4] (m^3/sec)	Whole-body Inhalation Dose Conversion Factors[5] (Rem/μCi)	Dose at Controlled Area Boundary (Rem)
H-3	1.38E+09	1E-2	2.41E-3	2.54E-4	1.25E-4	1.05E-03
Kr-85	2.23E+10	1E-2	2.4E-3	N/A	3.34E-4(6) $\frac{\text{Rem-m}^3}{\text{sec-Ci}}$	1.79E-04 (W-B Sumb.)
I-129	1.06E+05	1E-10	2.4E-3	2.54E-4	5.0 (thyroid)	1.62E-10 (thyroid)
Cs-134	1.89E+11	5E-10	2.4E-3	2.54E-4	4.55E-2	2.62E-06
Cs-137	3.18E+11	5E-10	2.4E-3	2.54E-4	3.26E-2	3.16E-06
Sr-90	2.24E+11	5E-10	2.4E-3	2.54E-4	2.4E-2	1.64E-06
Ru-106	4.83E+10	5E-10	2.4E-3	2.54E-4	6.18E-2	9.10E-07
				Total Whole Body Dose		1.245E-03

[1]NUREG-0575 (Ref. 9).

[2]SAND 80-2124 (ref. 10).

[3]FSAR (Ref. 11).

[4]Regulatory Guide 1.109 (Ref. 12).

[5]NUREG/CR-0150 Vol. 3 (Ref. 13).

[6]NUREG/CR-1918 (Ref. 14).

Table 6.3 Radiological Doses at the Nearest Resident from Storage Due to a Dry Shielded Canister Accident at the H. B. Robinson Steam Electric Plant

Nuclide	Cask Inventory[1] (μCi)	Total Fraction Released Aerosolized + Respirable[2]	X/Q[3] (sec/m^3)	Breathing Rate[4] (m^3/sec)	Whole-body Inhalation Dose Conversion Factors[5] (Rem/μCi)	Dose at the Nearest Resident (Rem)
H-3	1.38E+09	1E-2	7.00E-4	2.54E-4	1.25E-4	3.07E-4
Kr-85	2.23E+10	1E-2	7.00E-4	N/A	3.34E-4(6) $\frac{\text{Rem-m}^3}{\text{sec-Ci}}$	5.21E-05 (W-B Sumb.)
I-129	1.06E+05	1E-10	7.00E-4	2.54E-4	5.0 (thyroid)	4.71E-11 (thyroid)
Cs-134	1.89E+11	5E-10	7.00E-4	2.54E-4	4.55E-2	7.64E-7
Cs-137	3.18E+11	5E-10	7.00E-4	2.54E-4	3.26E-2	9.22E-7
Sr-90	2.24E+11	5E-10	7.00E-4	2.54E-4	2.4E-2	4.78E-07
Ru-106	4.83E+10	5E-10	7.700E-4	2.54E-4	6.18E-2	2.65E-07
				Total Whole Body Dose		3.61E-04

[1]NUREG-0575 (Ref. 9).

[2]SAND 80-2124 (ref. 10).

[3]FSAR (Ref. 11).

[4]Regulatory Guide 1.109 (Ref. 12).

[5]NUREG/CR-0150 Vol. 3 (Ref. 13).

[6]NUREG/CR-1918 (Ref. 14).

Table 6.2 and Table 6.3 summarize the radiological impact of a DSC accident containing 5-year cooled spent fuel. The upper bound dose at the controlled area boundary, due to the postulated accident, would be about 1.2 mrem to the whole-body and thyroid. The nearest resident would receive a dose to the whole-body and thyroid of about 0.4 mrem. If all the fuel rod cladding failed and 25 percent of the noble gas (Kr-85) inventory in 1 DSC were released, as was assumed by the applicant, the dose at the controlled area boundary would only be about 4.5 mrem to the whole-body. 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 72.68(b). These doses are also much less than the protective action guidelines 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 effected organ. Thus the release of effluents due to accidents at the ISFSI have a negligible impact on the population in the region around the H. B. Robinson Steam Electric Plant.

6.2.3 Nonradiological Impacts

6.2.3.1 Land Use and Terrestrial Resources

Operation of the ISFSI is not expected to adversely impact the terrestrial environment. Heat from the DSC's is not expected to be high enough to impact vegetation growing adjacent to the HSM's. Inhibited access to the ISFSI by the boundary fence of HBR 2 protected area and the lack of nearby vegetative cover will discourage wildlife species from using the area adjacent to the HSM's. During winter months some birds (pigeons, European starlings, morning doves, ring-billed gulls) may roost on the upper surface of the HSM's due to heat from the exit vents. The staff does not believe this aggregation of birds will result in adverse impact to individual birds. Wire mesh screens will be placed over the inlet and exit ports of the HSM's to prohibit entry of birds, wind-blown debris, etc.[4]

6.2.3.2 Water Use and Aquatic Resources

The H. B. Robinson ISFSI is a passive system cooled by air; there is no planned water use nor liquid releases to local surface or ground water supplies associated with operation of the ISFSI. Surface runoff from precipitation is not expected to result in negative impact to Lake Robinson water quality. The ISFSI will be built in a level area, nearly enclosed in an easterly direction by various buildings associated with HBR 2; thus the likelihood is low that runoff from the ISFSI would enter the lake.

6.2.3.3 Other Impacts of Operation

During rainy days, precipitation may vaporize upon impact with the surface of the HSM's and as a result of the temperature of the outlet air. Consequently fog may form above the HSM's. However, a significant increase in the amount of fog extending beyond the plant's exclusion boundary is not expected to occur. Noise associated with operation of the ISFSI will result from transfer of the designated spent fuel from the spent fuel pool facility to the horizontal storage modules. 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.

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 the measures presently in effect for the protection of the H. B. Robinson operating reactor, and establishes additional safeguards specifically around the stored fuel. The combined plans assure that:

- Access to the site is controlled and limited to those individuals who are authorized,
- Unauthorized intrusions or activities are detected in a timely manner,
- Armed responders are immediately available to counter the threat,
- There is capability to call for assistance from local police units,
- 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.

Irradiated (spent) fuel removed from light water cooled power reactors (LWRS) contains low enriched uranium, fission products, and plutonium and other transuranics. It is highly radioactive and requires heavy shielding for safe handling. 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, viz., it 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

A proposed decommissioning plan[3] was included as part of the application in accordance with 10 CFR 72.18.* The only activities expected in decommissioning the H. B. Robinson ISFSI are the removal of the spent fuel from the site for transfer to a federal repository and the decontamination and the dismantling of the concrete HSM's. Presently CP&L expects to be able to remove the DSC's containing the spent fuel from the HSM's and place them in its GE IF-300 transportation cask for shipment to the Federal repository, when such a facility is ready. If the fuel must be removed from the DSC's for transport or disposal, the canister could be decontaminated and disposed of as low-level waste. The HSM's are expected to have minimal contamination of their internals and air passages, which could be easily removed. Then, the reinforced concrete modules could be broken up and removed. No residual contamination is expected to be left behind on the concrete pads.

The costs of decommissioning the ISFSI are expected to represent a small and negligible fraction of the costs of decommissioning the H. B. Robinson Steam Electric Plant Unit 2.

*Under Section 51.20(b)(10) of 10 CFR Part 51, an environmental impact statement must be prepared in connection with the issuance of a license amendment authorizing decommissioning of an ISFSI. However, the proposed action here is limited to construction and operation. A request for authority to decommission, contemplated by Section 72.38 of 10 CFR Part 72, will come at a later date. New 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 regulation changes is the deletion of the requirement in Section 51.20(b)(10) to prepare an environmental impact statement 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 on the H. B. Robinson Unit 2 site. 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 applicant is committed to the implementation of "good construction practices" during ISFSI construction. The only resources committed irretrievably are the steel and concrete used in the eight ISFSI storage modules, pads, and canisters.

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 H. B. Robinson Unit 2 FES's and are controlled by the existing Technical Specification for the reactor. The primary exposure pathway associated with the ISFSI operation is direct irradiation of site workers and nearby residents. The dose commitment to the nearest resident from the ISFSI operation is about 0.4 mrem/yr and when added to that of the H. B. Robinson Unit 2 operations is much less than 25 mrem/yr as required by 10 CFR 72.67. The collective dose commitment to residents within one mile of the ISFSI is about 9E-3 man-rem/yr. Occupational dose of site workers during HSM construction (0.1 man-rems) and during ISFSI operation (27 man-rems/yr) is a small fraction of the total occupational dose commitment at the H. B. Robinson Steam Electric Plant Unit 2. (i.e., 1007 man-rem/yr is the annual average occupational dose over 10 years ending in 1983). Individual doses are controlled to be within the limits established by 10 CFR Part 20.

The upperbound radiological impacts due to accidents at the H. B. Robinson ISFSI are about 1.2 mrem to the whole-body and thyroid of an individual located at the controlled area boundary and about 0.4 mrem to the nearest resident. These doses are only a small fraction of the criteria specified in 10 CFR 72.68(b) and by the EPA Protective Action Guides. An Emergency Planning Zone (EPZ) is being considered which would coincide with the ISFSI controlled area and the H. B. Robinson Steam Electric Plant Unit 2 site boundary.

As discussed in Section 6.2.3, no significant nonradiological impacts are expected during operation. 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 H. B. Robinson 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. U.S. Nuclear Regulatory Commission, "Final Environmental Statement related to Operation of H. B. Robinson Nuclear Steam-Electric Plant," Docket No. 50-261, April 1975.

2. 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.

3. Carolina Power and Light Company, Letter to the U.S. Nuclear Regulatory Commission, submitting License Application for H. B. Robinson Independent Spent Fuel Storage Installation, February 4, 1985.

4. Carolina Power and Light Company, "Environmental Report - H. B. Robinson Steam Electric Plant, Independent Spent Fuel Storage Installation," February 1985.

5. Carolina Power and Light Company, "Safety Analysis Report - H. B. Robinson Steam Electric Plant, Independent Spent Fuel Storage Installation," February 1985.

6. Carolina Power and Light Company, "Safety Analysis Report - H. B. Robinson Steam Electric Plant Unit No. 2," Volume 1, July 1982.

7. Effluent and Waste Disposal Semiannual Reports, letter from R. B Starkey, Jr., (CP&L) to James P. O'Reilley (NRC) dated August 29, 1983, and letter from R. E. Morgan (CP&L) to James P. O'Reilley (NRC) dated February 29, 1984.

8. U.S. NRC, "Occupational Radiation Exposure at Commercial Nuclear Power Reactors - 1983 Annual Report," NUREG-0713 Vol. 5, March 1985.

9. U.S. NRC, "Final Generic Environmental Impact Statement on Handling and Storage of Spent Light Water Power Reactor Fuel," NUREG-0570, August 1979.

10. E. L. Wilmont, "Transportation Accident Scenarios for Commercial Spent Fuel," SAND 80-2124, Sandia National Laboratories, Albuquerque, NM, February 1981.

11. CP&L, "H. B. Robinson Steam Electric Plant Unit No. 2 Updated Final Safety Analysis Report," Docket No. 50-261, July 20, 1984.

12. U.S. NRC, "Calculation of Annual Doses to Man From Routine Releases of Reactor Effluents For The Purpose of Evaluating Compliance With 10 CFR Part 50, Appendix I," Regulatory Guide 1.109, October 1977.

13. D. E. Dunning, Jr. et al., "Estimates of Internal Dose Equivalents to 22 Target Organs for Radionuclides Occurring in Routine Releases from Nuclear Fuel-Cycle Facilities, Vol III," NUREG/CR-0150, Vol. 3, prepared for the NRC by Oak Ridge National Laboratory, Oak Ridge, Tennessee, October 1981.

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, Tennessee, August 1981.

11.0 LIST OF AGENCIES AND PREPARERS

No outside Agencies were consulted. Those NRC staff members principally responsible for the operation of this EA are listed below:

Name	Responsibility
E. Pentecost	Project Leader, Principal Author
C. Gaskin	Safeguards for Spent Fuel
F. Sturz	Project Manager and Radiological
W. Swick	Word Processing

NMSS / Fuel Cycle Material

FCUF ______

FCAF ✓

File: Docket # 72-3 main file

Project # ______

Other 50-261

PDR yes

LPDR yes

Return to F Brown

[illegible] 396