CHAPTER 9

CONDUCT OF OPERATIONS

9.0 CONDUCT OF OPERATIONS

9.1 ORGANIZATIONAL STRUCTURE

The development of the Independent Spent Fuel Storage Installation (ISFSI) was managed by Carolina Power & Light (CP&L) Company with support from NUTECH Engineers, Inc. (NUTECH), the U. S. Department of Energy (DOE), and the Electric Power Research Institute (EPRI). Final responsibility for construction, preoperational testing, startup, and operation of the ISFSI remains with CP&L. Therefore, CP&L's organization and its interfaces with outside support organizations are described below.

9.1.1 CORPORATE ORGANIZATION

CP&L is engaged in the production, transmission, distribution, and sale of electric energy to residential, commercial, and industrial customers spread over a service area of 30,000 sq. mi. in North and South Carolina. The Company has extensive experience in the design, construction, startup, testing, operating, and staffing of modern generating facilities. The Company's management of nuclear activities is described in Reference 9.1.

9.1.1.1 Corporate Functions, Responsibilities, and Authorities

CP&L’s corporate staff was responsible for installation engineering and design, quality assurance, and acceptance of testing results for the ISFSI. The Nuclear Fuels Section (NFS) and the Nuclear Engineering Department (NED) were jointly responsible for the engineering and design of the ISFSI and the acceptance of test results prior to operation.

An overall Program Manager within the NED was responsible for execution of the program until completion of fuel loading.

9.1.1.2 Applicant's In-House Organization

The corporate organization is shown in Reference 9.2, Figure 13.1.1-1. Ultimate responsibility for operation of the ISFSI rests with the Senior Vice President and Chief Nuclear Officer – Nuclear Generation Group reporting to the Group President - Energy Supply. The details of the responsibilities of the CP&L Groups and Departments are described in Section 13.1 of the HBR2 Updated Final Safety Analysis Report (UFSAR) (Reference 9.2).

9.1.1.3 Interrelationships with Contractors and Suppliers

The development of the ISFSI was managed by CP&L with support from DOE and EPRI. NUTECH, CP&L's subcontractor, provides certain engineering, technical support, and other services for the program relating primarily to the NUTECH Horizontal Modular Storage (NUHOMS) system design. CP&L and other subcontractors provide the remaining engineering, technical support, and services.

9.1.1.4 Applicant's Technical Staff

The Corporate technical staff supporting the ISFSI is described in Section 13.1.1 of Reference 9.2.

9.1.2 OPERATING ORGANIZATION, MANAGEMENT, AND ADMINISTRATIVE CONTROLS SYSTEM

9.1.2.1 Onsite Organization

Operation of the Facility is the responsibility of CP&L, primarily by the H. B. Robinson Steam Electric Plant, Unit No. 2 (HBR2), Operations Unit, with support by the Robinson Engineering Section. The RNP Nuclear Oversight Section is responsible for performing periodic assessments of ISFSI activities. The on-site organization is described in Reference 9.2, Chapter 13.1.2.

9.1.3 PERSONNEL QUALIFICATION REQUIREMENTS

9.1.3.1 Minimum Qualification Requirements

Minimum qualification requirements are discussed in Reference 9.2 Section 13.1.3.

9.1.4 LIAISON WITH OUTSIDE ORGANIZATIONS

The development of the ISFSI was managed by CP&L with support from NUTECH, DOE, and EPRI. NUTECH, CP&L's subcontractor, provided certain engineering, technical support, and other services for the program relating primarily to the NUHOMS system design. The overall program was conducted under a Program Management Plan which had been approved under the DOE/CP&L Cooperative Agreement (Reference 9.4). This Program Management Plan provided for an oversight committee which includes representatives of CP&L, DOE, and EPRI. The oversight committee was responsible for input to, and approval of, the schedular, technical, procedural, and administrative details of the program. EPRI, acting through and in cooperation with CP&L (Reference 9.5), participated in the formulation and formal definition of the research and development aspects of the program. DOE participated in the program through financial and/or in-kind services (DOE/CP&L Cooperative Agreement). Program review and guidance was provided to CP&L by all participants. The design, procurement, construction, and operation of the HBR ISFSI are controlled through existing CP&L procedures and programs. Operation of the Facility is the sole responsibility of CP&L.

9.2 PRE-OPERATIONAL TESTING AND OPERATION

Two types of tests were planned prior to loading of spent fuel. The first is thermal testing of the DSC/HSM system to verify its heat removal capacity; the second is testing of the DSC transfer system to ensure a safe, smooth DSC insertion into the HSM and back to the cask.

It was only necessary to perform the thermal tests only upon the first HSM and DSC (or prototype) constructed. Subsequent units built to the same requirements may be safely presumed to operate in a similar manner. Likewise, handling tests need only be performed once, since all future operations will use equipment proven during pre-operational testing or equipment fabricated from those plans.

9.2.1 ADMINISTRATIVE PROCEDURES FOR CONDUCTING TEST PROGRAM

Existing HBR2 modification procedures will be followed for the ISFSI test program.

9.2.2 CP&L TEST PROGRAM DESCRIPTION

Thermal testing was planned to be performed using one of the completed HSMs. The DSC need not be an exact replica of the actual stainless steel canister, but may be simply an appropriately sized closed-end pipe. Resistance-type electric heating elements within the DSC replica will simulate decay heat. The purpose of this test is to verify the thermal-buoyancy driven convective air flow through the HSM.

Handling testing was planned to be performed using the actual HSM, a DSC replica and the associated transfer handling equipment. The purpose of this series of tests is to ensure that all DSC handling operations will be performed safely. The tests simulate, as nearly as possible, actual handling operations with spent fuel including mock-ups for performing the DSC welding operations. Off-normal handling conditions need not be addressed, since the DSC can remain in the cask indefinitely or be returned to the spent fuel pool, if proper alignment cannot be achieved.

9.2.3 TEST DISCUSSION

9.2.3.1 Physical Facilities Testing (Thermal Testing of HSM and DSC)

The DSC replica will be placed in the HSM and internally heated by electric resistance heaters. Heat flux will simulate the decay heat value of seven assemblies (7 kw). The purpose of the test is to verify the passive heat removal capacity of the HSM/DSC. The test will measure the difference between entering and exiting air temperatures. The expected response is that exit air will be 100EF above entering air temperature. The air flow volume will be measured to allow computation of heat flow by convection through the module. This test will be repeated with partial and complete blockage of the HSM air passages.

If the results of the tests showed that insufficient convective cooling occurs, resulting in elevated concrete and fuel cladding temperatures, corrective measures could have been taken and the test repeated.

9.2.3.2 Operations Testing (Handling Tests)

The purpose of the handling tests is to verify that the DSC handling system is adequate to achieve alignment of the cask with the HSM and insertion of the DSC into the HSM.

The expected response of the system testing is that alignment and insertion may be achieved. A successful test is one in which alignment and insertion is achieved without damage to system components.

Corrective action, in the event of an unsuccessful test, would have been to modify system components as appropriate.

Handling tests were also planned to be conducted to ensure that the DSC can be removed from the HSM, returned to the IF-300 shipping cask, and returned to the HBR2 spent fuel pool.

9.3 TRAINING PROGRAM

9.3.1 PLANT STAFF TRAINING PROGRAM

The training programs for HBR2 were modified to incorporate the operation of the Independent Spent Fuel Storage Installation. Since the ISFSI is essentially a passive structure with no equipment or instrumentation required for normal operation, the operator training program will concentrate on the accident training. In addition to the operator training, the radiation protection and fire brigade training programs have been expanded to cover the ISFSI.

The current HBR2 plant staff training program is described in Section 13.2 of the HBR2 Updated FSAR (Reference 9.2).

9.3.2 REPLACEMENT AND RETRAINING PROGRAM

The HBR2 replacement training and retraining programs have been updated to include the ISFSI.

The current HBR2 replacement and retraining programs are described in Section 13.2 of the HBR2 Updated FSAR (Reference 9.2).

9.4 NORMAL OPERATIONS

The HBR ISFSI provides an independent and passive system for the dry storage of irradiated fuel. No radioactive waste or auxiliary systems are required during normal storage operations.

9.4.1 PROCEDURES

Although not considered normal operations, the processes for transfer of the fuel from the spent fuel pool to the horizontal storage modules (HSMs) are briefly discussed below. These processes will be conducted only when loading and unloading the ISFSI. Specific procedures were developed for transporting, loading into the HSM, and retrieving operations involving the dry shielded canister (DSC). The existing HBR2 procedures for handling irradiated fuel in the spent fuel pool, loading of the GE IF-300 shipping cask, and handling by the spent fuel crane will be used for these ISFSI operations. As discussed in Chapter 6, some waste and auxiliary systems are required during the DSC loading, drying and transfer into the module. The waste systems handle the spent fuel pool water, air, and inert gas which are vented from the DSC and cask during drying. Auxiliary handling systems (such as hydraulic pressure, control, alignment, crane, etc.) are also required during the loading and transfer operation.

9.4.2 RECORDS

The ISFSI records will be maintained in accordance with existing HBR2 procedures.

9.5 EMERGENCY PLANNING

The Emergency Program for HBR2 has been determined to be adequate for events which might occur involving the Independent Spent Fuel Storage Installation. The Emergency Program for HBR2 consists of the Robinson Emergency Plan and its implementing Procedures. Also included are related radiological emergency plans and procedures of state and local organizations. The purpose of these programs is to provide protection of plant personnel and the general public and to prevent or mitigate property damage that could result from an emergency at the HBR2 Plant. The combined emergency preparedness programs have the following objectives:

a) Effective coordination of emergency activities among all organizations having a response role.

b) Early warning and clear instructions to the population-at-risk in the event of a serious radiological emergency.

c) Continued assessment of actual or potential consequences both on-site and off-site.

d) Effective and timely implementation of emergency measures.

e) Continued maintenance of an adequate state of emergency preparedness.

The HBR2 Emergency Plan has been prepared in accordance with Section 50.47 and Appendix E of 10 CFR Part 50. The Plan shall be implemented whenever an emergency situation is indicated. Radiological emergencies can vary in severity from the occurrence of an abnormal event, such as a minor fire with no radiological health consequences, to nuclear accidents having substantial onsite and/or offsite consequences.

In addition to emergencies involving a release of radioactive materials, events such as security threats or breaches, fires, electrical system disturbances, and natural phenomena that have the potential for involving radioactive materials are included in the Plan. Other types of emergencies that do not have a potential for involving radioactive materials are not included in the Plan.

The activities and responsibilities of outside agencies providing an emergency response role at the HBR Plant site are summarized in the Plan (for completeness) and detailed in the State Emergency Plans.

The Plan provides the basis for performing advance planning and for defining specific requirements and commitments to be implemented by other documents and procedures. The HBR2 Plant site procedures provide the detailed actions and instructions that will be required to implement the Plan in the event of an emergency.

The emergency response resources available to respond to an emergency consist of the personnel at Corporate Headquarters, at other CP&L facilities, and, in the longer term, at organizations involved in the nuclear industry. The first line of defense in responding to an emergency lies with the normal operating shift on duty when the emergency begins. Therefore, members of the HBR2 staff are assigned defined emergency response roles that are to be assumed whenever an emergency is declared. The overall management of the emergency is normally performed by plant management. Onsite personnel have preassigned roles to support the Site Emergency Coordinator/Emergency Response Manager and to implement their directives. These roles, for the purpose of emergency planning, are cast in terms of emergency teams and assignments, each having a designated person assigned to it.

Special provisions have been made to assure that ample space and proper equipment are available to effectively respond to the full range of possible emergencies.

The emergency facilities available include the Robinson Plant Control Room, Operational Support Center, Technical Support Center, Emergency Operations Facility, Joint Information Center, and Harris Energy & Environmental Center. Descriptions of these facilities as well as the South Carolina EOC, the Darlington County EOC, the Lee County EOC, and the Chesterfield County EOC, are described in the Plan.

Emergency plan implementing procedures define the specific (i.e., step-by-step) actions to be followed in order to recognize, assess, and correct an emergency condition and to mitigate its consequences. Procedures to implement the Plan provide the following information:

a) Specific instructions to the plant operating staff for the implementation of the Plan.

b) Specific authorities and responsibilities of plant operating personnel.

c) A source of pertinent information, forms, and data to ensure prompt actions are taken and that proper notifications and communications are carried out.

d) A record of the completed actions.

e) The mechanism by which emergency preparedness will be maintained at all times.

9.6 DECOMMISSIONING PLAN

The HBR ISFSI makes provisions for the dry storage canister to be transferred to a federal repository when such a facility becomes operational. The concrete storage module is designed so that the canister can be safely returned to a shipping cask and transported offsite to the federal facility.

The shipping cask design and transportation requirements will depend on the regulations in effect at the time when the federal facility begins receiving spent fuel. In the absence of new regulations, it is likely that the existing GE IF-300 shipping cask would be used to transport the canisters.

Upon removal of the canisters, the level of contamination within the concrete module is expected to be extremely low and would be removed so that the concrete could be broken-up and removed by conventional methods.

Section 3.5 of this report discusses decommissioning considerations for the HBR ISFSI.

9.7 LICENSE RENEWAL ACTIVITIES

9.7.1 AGING MANAGEMENT PROGRAMS

An assessment of the RNP ISFSI and Transfer Cask inspection and monitoring activities identified existing activities necessary to provide reasonable assurance that ISFSI and Transfer Cask components within the scope of license renewal will continue to perform their intended functions consistent with the current licensing basis (CLB) for the renewal period. This section describes these aging management programs.

9.7.1.1 ISFSI AGING MANAGEMENT PROGRAM

The RNP ISFSI Aging Management Program involves monitoring the exterior surface of the horizontal storage module. It includes visual inspection of the accessible concrete (including below grade concrete, if exposed during excavation) and any exposed steel embedments and attachments. It also includes monitoring the area radiation levels, airborne contamination, and smearable contamination at selected areas of the ISFSI. This is primarily a condition monitoring program, however, preventive actions include a daily surveillance to ensure horizontal storage module air inlets and outlets are not obstructed.

9.7.1.2 TRANSFER CASK AGING MANAGEMENT PROGRAM

The Transfer Cask Aging Management Program performs visual inspections of the exterior surfaces of the IF-300 Transfer Cask, cask collar, and lid. The program also monitors the water chemistry of the cask neutron shield water jacket to prevent the corrosion of exposed internal surfaces.

Note: If the environmental conditions are changed at a later date, such as by moving the cask to indoor storage or draining the neutron shield water jacket fluid, there will be no need to continue visual inspections of the external stainless steel surfaces or to continue monitoring the chemistry of the neutron shield water jacket.

9.7.2 TIME-LIMITED AGING ANALYSIS

This section discusses the results for each of the time-limited aging analyses (TLAAs) evaluated for license renewal. The evaluations have demonstrated that the analyses are valid through the end of the renewed license period.

9.7.2.1 DSC SHELL CRACKING DUE TO FATIGUE

The Dry Shielded Canister (DSC) shell fatigue cumulative usage factor (CUF) was calculated to be 0.21 for the first 50 years of service. The additional 10 years of service was estimated to increase the usage factor to 0.25. This value is less than the allowable 1.0. Therefore, the CUF has been reanalyzed and projected to be valid for the renewed license period.

9.7.2.2 DSC PENETRATION ASSEMBLY EPOXYLITE SEAL CHANGE IN MATERIAL PROPERTIES DUE TO IONIZING RADIATION

Two of the DSCs contain sheathed thermocouple feeds through a penetration plug assembly in the bottom end plug, which were sealed (wire to sheathing) using a heat-cured epoxy-resin material. The integrated exposure for epoxy-resin after 40 years was calculated to be 2.21E11 ergs/g, and after 50 years calculated to be 2.56E11 ergs/g. The integrated exposure after 60 years of service was projected to be less than 2.91E11 ergs/g. This is well below the acceptable level of 1E12 ergs/g for this type of resin. In addition, the validity of the assumed negligible effects of neutron radiation was confirmed for the renewed license period. Therefore, the effects of ionizing radiation on the epoxy-resin have been reanalyzed and projected to be valid for the renewed license period.

9.7.2.3 DSC POISON PLATE DEPLETION OF BORON

Boron depletion can result in reduced neutron absorption capability for neutron poison materials, such as the aluminum boron metal used in the DSC baskets. The total flux was estimated to be 4.1E8 n/cm^2/sec. After 60 years of service, the total flux (fluence) is estimated to be 7.8E17 n/cm^2. Conservatively assuming that the total flux is

thermal, the depletion in Boron B-10 level will be negligible (less than 0.3 %). Therefore, DSC Poison Plate Depletion of Boron has been reanalyzed, boron depletion has been determined to be negligible, and this has been projected to be valid for the renewed license period.

9.7.2.4 5% BORON-POLYETHYLENE FRONT ACCESS COVER PLATE CRACKING AND CHANGE IN MATERIAL PROPERTIES DUE TO IONIZING RADIATION

The front access cover plate on each horizontal storage module is a carbon steel plate and frame that encloses a lead plate and a 2-inch thick boron-polyethylene sheet. Degradation of the boron-polyethylene sheet due to ionizing radiation may result in reduced shielding capability. The gamma dose rate on the inside face of the access cover plate was calculated to be 23 mR/hr, which results in a gamma radiation dose of less than the allowable 5E8 Rads over a life of 60 years. The neutron dose on the inside face of the front access cover plate was calculated to be 1.14E12 n/cm^2, which is less than the allowable 2.5E13 n/cm^2 over a life of 60 years. Therefore, degradation of the boron-polyethylene sheets due to ionizing radiation has been reanalyzed and projected to be valid for the renewed license period.

REFERENCES: CHAPTER 9

9.1 Carolina Power & Light Company, Harris Nuclear Project, "Management Capability Report," letter from E. E. Utley (CP&L) to H. R. Denton (NRC) dated January 10, 1984.

9.2 Carolina Power & Light Company, "H. B. Robinson Steam Electric Plant Unit No. 2 Updated Final Safety Analysis Report," Docket No. 50-261, License No. DPR-23.

9.3 Carolina Power & Light Company, "Technical Specifications and Bases for H. B. Robinson Unit No. 2," Appendix A to Facility Operating License DPR-23, Docket No. 50-261, Darlington County, SC.

9.4 CP&L/DOE Licensed At-Reactor Dry Storage Demonstration Program, Cooperative Agreement No. DE-FC06-84RL10532, Amendment No. A000, March 1984.

9.5 Associate Party Agreement Between CP&L and EPRI, Inc., RP2566-1, July 1984.