CHAPTER 9

CONDUCT OF OPERATIONS

LIST OF EFFECTIVE PAGES

PAGE	REVISION	PAGE	REVISION
LEP 9-1	20		
9-i	15		
9-ii	15		
9-iii	20		
9-iv	15		
9.1-1	15		
9.1-2	15		
9.2-1	8		
9.2-2	8		
9.2-3	8		
9.3-1	8		
9.3-2	8		
9.4-1	20		
9.4-2	20		
9.4-3	20		
9.4-4	20		
9.4-5	20		
9.4-6	20		
9.4-7	20		
9.4-8	20		
9.5-1	8		
9.6-1	15		
9.7-1	20		

CHAPTER 9

CONDUCT OF OPERATIONS

TABLE OF CONTENTS

CHAPTER 9

CONDUCT OF OPERATIONS

TABLE OF CONTENTS

CHAPTER 9

CONDUCT OF OPERATIONS

LIST OF TABLES

CHAPTER 9

CONDUCT OF OPERATIONS

LIST OF ACRONYMS

BGE	Baltimore Gas and Electric Company
CCNPP	Calvert Cliffs Nuclear Power Plant
CFR	Code of Federal Regulations
DSC	Dry Shielded Canister
ERP	Emergency Response Plan
HSM	Horizontal Storage Module
IFA	Irradiated Fuel Assembly
ISFSI	Independent Spent Fuel Storage Installation
NFSS	Nuclear Fuel Services Section
NUHOMS	Nutech Horizontal Modular Storage
SFSP	Spent Fuel Storage Project
SNM	Special Nuclear Material
UFSAR	Updated Final Safety Analysis Report

9.0 CONDUCT OF OPERATIONS

9.1 ORGANIZATIONAL STRUCTURE

9.1.1 CORPORATE ORGANIZATION

The Calvert Cliffs Independent Spent Fuel Storage Installation (ISFSI) is operated under the same corporate management organization responsible for operation of the Calvert Cliffs Nuclear Power Plant (CCNPP). This organization is described in Section 12.1 of the CCNPP Updated Final Safety Analysis Report (UFSAR).

9.1.1.1 Corporate Functions, Responsibilities, and Authorities

The corporate organization described in UFSAR Section 12.1, provides line responsibility for operation of Constellation Generation Group, LLC. Various departments within the Company have responsibility for design, construction, quality assurance, testing, and operation of CCNPP as well as the ISFSI. Constellation Generation Group, LLC corporate functions, responsibilities, and authorities for quality assurance, as described in Chapter 11, are applicable for appropriate portions of the ISFSI.

9.1.1.2 Applicant's In-House Organization

Constellation Generation Group, LLC's, Nuclear Fuel Services Section (NFSS) has the specific responsibility for design of structures and systems, specifications, and procurement of materials and equipment, and preparation of construction and installation drawings for the ISFSI. The Director-NFSS has overall responsibility for the design of CCNPP including the ISFSI. The Nuclear Fuel Management Unit of this section maintains responsibility for management of spent fuel.

Calvert Cliffs Nuclear Power Plant Department is responsible for operation and maintenance of CCNPP. This department provides general supervision and technical management services for the plant and is responsible for ISFSI maintenance.

9.1.1.3 Interrelationship with Contractors and Suppliers

The prime contractor for design and analysis of the Calvert Cliffs ISFSI is Transnuclear (formerly Nutech Engineers, Inc.). The ISFSI is owned and operated by CCNPP. Construction of the ISFSI was the responsibility of an approved construction contractor. Licensing support, Geotechnical Engineering and Quality Assurance Program revisions were performed by Duke Engineering and Services utilizing Duke Power Company personnel experienced on the Oconee Nuclear Station ISFSI. Subsurface investigations at the ISFSI site were performed by Law Engineering Testing Company.

9.1.1.4 Applicant's Technical Staff

The Corporate technical staff supporting the ISFSI is described in UFSAR Section 12.1.

9.1.2 OPERATING ORGANIZATION, MANAGEMENT, AND ADMINISTRATIVE CONTROL SYSTEM

9.1.2.1 On-site Organization

The on-site organization of CCNPP is responsible for operation of the ISFSI. The Nuclear Fuels Management Unit of the NFSS maintains primary responsibility for spent fuel storage. The organization for CCNPP is fully described in UFSAR Section 12.1.

9.1.2.2 Personnel Functions, Responsibilities, and Authorities

The functions, responsibilities, and authorities of major personnel positions, including discussions of specific succession of responsibility for overall operation of CCNPP are described in UFSAR Section 12.1. These functions, responsibilities, and authorities extend to the Calvert Cliffs ISFSI.

9.1.3 PERSONNEL QUALIFICATION REQUIREMENTS

The minimum qualification requirements for major operating, technical and maintenance supervisory personnel, as well as the qualifications of persons assigned to managerial and technical positions, are as stated in UFSAR Section 12.1.

9.1.4 LIAISON WITH OTHER ORGANIZATIONS

Arrangements made with outside organizations are as described in Section 9.1.1.3 of this Chapter.

9.2 PREOPERATIONAL TESTING AND OPERATION

Prior to operation of the ISFSI, complete functional tests of the in-plant operations, transfer operations, and horizontal storage module (HSM) loading and retrieval were performed. These tests verified that the storage system components [e.g., dry shielded canister (DSC), transfer cask, transfer trailer, etc.] can be operated safely and effectively (Reference 9.12**).**

9.2.1 ADMINISTRATIVE PROCEDURES FOR CONDUCTING TEST PROGRAM

Preoperational testing was governed by Calvert Cliffs administrative procedures for conducting testing.

9.2.2 TEST PROGRAM DESCRIPTION

The testing program required use of a DSC, DSC mock-up, transfer cask and associated handling equipment, transfer trailer, and an HSM. The tests simulated, as nearly as possible, the actual operations involved in preparing a DSC for storage and demonstrated that they can be performed safely during actual emplacement of irradiated fuel assemblies (IFAs) in the ISFSI. Shielding verification, which is not completely achievable during dry runs, was accomplished during the initial IFA loadings.

9.2.2.1 Physical Facilities and Operations

9.2.2.1.1 Dry Shielded Canister and Associated Equipment

An actual DSC and a part-length mock-up of a DSC were used for preoperational testing. The DSC was loaded into the transfer cask to verify fit and suitability of the DSC lift rig. Additionally, the DSC was used in operational testing of the transfer equipment and HSM.

The part-length mock-up was configured exactly as the top end of the DSC with lead shield plug and covers. The mock-up was used for checkout of the automated welding equipment including actual welding of the simulated lead shield plug and top cover plate. Emphasis was placed on acceptability of the weld, as well as compliance with approved as low as reasonably achievable practices.

9.2.2.1.2 Transfer Cask and Handling Equipment

Functional testing was performed with the transfer cask and lifting yoke. These tests demonstrated that the transfer cask can be safely transported from the Auxiliary Building truck bay to the cask washdown pit. From there, it was placed into the spent fuel pool to verify clearances and travel path.

9.2.2.1.3 Off-Normal Testing of the DSC and Transfer Cask

In the unlikely event that a problem arises during actual loading of the IFAs into the DSC, seal welding of the DSC, or during emplacement of a loaded DSC into an HSM, no immediate action would be required since the fuel assemblies would be in a safe condition. The pre-operational testing program confirmed that the IFAs can be safely removed from the DSC by demonstrating that the DSC lids can be removed.

9.2.2.1.4 Transfer Trailer and HSM

The transfer cask was placed on the transfer trailer, and then transported to the ISFSI and aligned with an HSM. Compatibility of the transfer trailer with the transfer cask, negotiation of the travel path to the ISFSI, and maneuverability within the confines of the ISFSI were verified.

The transfer trailer was aligned and docked to the HSM. The hydraulic ram was used to emplace a DSC loaded with test weights in the HSM and remove it. Loading of the DSC into the HSM verified that the transfer skid alignment system, hydraulic positioners, and ram grapple assembly all operate safely for both emplacement of a DSC into, and removal from, a HSM.

9.2.2.1.5 Off-Normal Testing of the Transfer Trailer and HSM

In the unlikely event that a problem should occur that prevents loading the DSC into the HSM, no immediate remedial action will be required. Irradiated fuel assemblies may be stored in the transfer cask while corrective action is taken.

The most severe condition would occur if a failure of the hydraulic ram, after partial insertion of a DSC into an HSM, were to prevent complete emplacement of the DSC. (Radiological shielding and decay heat removal are not compromised by this condition, but the transfer trailer may not be moved away until the DSC is completely within the confines of either the transfer cask or the HSM.) Pre-operational testing verified that reversal of DSC movement can be completed by the operator of the hydraulic ram.

9.2.3 TEST DISCUSSION

The purpose of the preoperational tests was to ensure that a DSC can be properly and safely placed in the spent fuel pool, loaded with IFAs, transported to the ISFSI, emplaced in the HSM, and removed from the HSM. Proper operation of the DSC, transfer cask, and transfer trailer, as well as the associated handling equipment (e.g., lifting yoke, welding equipment, vacuum drying equipment), provided such assurance.

Preoperational test requirements were specific. Detailed procedures were developed and implemented by Calvert Cliffs personnel who were responsible for ensuring that the test requirements were satisfied.

The expected results of the preoperational tests were the successful completion of the following: loading of a DSC into the transfer cask, seal welding of the mock-up DSC, placement of a DSC into the transfer cask into and out of the spent fuel pool, transporting the transfer cask loaded with a DSC and test weights to the ISFSI, and emplacement in an HSM and removal from an HSM. The tests were deemed successful since the expected results were achieved safely and without damage to any of the components or associated equipment.

Any equipment or components which required modification in order to achieve the expected results were retested to affirm that the modification was sufficient. If any pre-operational procedures were changed in order to achieve the expected results, the changes were incorporated into the appropriate operating procedures.

Power operation of CCNPP was not affected by testing of the storage system, and in-plant testing was conducted concurrently with plant operation. In-plant testing was conducted entirely within the Auxiliary Building, and was scheduled so that there was no conflict with refueling. All normal prerequisites for safe handling of components in, or near, the spent fuel pool were satisfied, and normal safety and radiological practices were employed.

9.3 TRAINING PROGRAM

All personnel working at the Calvert Cliffs ISFSI receive training and indoctrination geared toward providing and maintaining a well-qualified work force for safe and efficient operation of the ISFSI. The existing Calvert Cliffs training program, as described in CCNPP UFSAR Section 12.2, is used to provide this training and indoctrination. Additional sections have been added to this program to include information specific to the ISFSI.

9.3.1 PROGRAM DESCRIPTION

9.3.1.1 Training for ISFSI Operations Personnel

Generalized training is provided to operations personnel in the applicable regulations and standards and in the nuclear engineering principles of cooling, radiological shielding, and structural characteristics of the DSC/HSM.

Detailed operator training is provided for DSC preparation and handling, fuel loading, transfer cask preparation and handling, and transfer trailer loading.

9.3.1.2 Training for Maintenance Personnel

Generalized training is provided to maintenance personnel on the applicable regulations and standards and on the nuclear engineering principles of cooling, radiological shielding, and structural characteristics of the DSC/HSM.

Specific training is provided for use of the automated seal welding equipment for the top end shield plug and top cover plate, operation of the transfer trailer, alignment of the cask skid with the HSM, alignment of the hydraulic ram assembly, and normal and off-normal operation of the hydraulic ram. Specific training is also provided for cleaning of the HSM air inlets and outlets.

9.3.1.3 Training for Health Physics Personnel

Generalized training is provided to Health Physics personnel on the applicable regulations and standards and on the nuclear engineering principles of cooling, radiological shielding, and structural characteristics of the DSC/HSM.

Specific training is provided in radiological shielding design of the system, particularly the top end shield plug, DSC/transfer cask and the DSC/HSM.

9.3.1.4 Training for Security Personnel

Details of the training program for security personnel are provided in the Security Plan which is withheld from public disclosure in accordance with Title 10, Code of Federal Regulations (CFR) 2.790(d) and 10 CFR 73.21.

9.3.2 RETRAINING PROGRAM

Retraining is consistent with retraining requirements in effect at CCNPP for personnel involved in fuel handling operations.

9.3.3 ADMINISTRATION AND RECORDS

The organization responsible for training programs and for maintaining up-to-date records on the status of personnel training is the existing Nuclear Training Section at Calvert Cliffs.

9.4 NORMAL OPERATIONS

The Calvert Cliffs ISFSI utilizes the Nutech Horizontal Modular Storage® (NUHOMS) system, which is completely passive during storage. Therefore, no monitoring instruments or limiting control settings are utilized at the ISFSI. Other limits and controls that are applied to the system during fuel loading and DSC transfer to the ISFSI are the fuel selection criteria, DSC surface contamination limits and DSC vacuum and helium backfill pressures, DSC closure weld examination requirements, and cask height restrictions during transport.

The components of storage, the DSC, the HSM, and (during transfer) the transfer cask, have been analyzed for all credible equipment failure modes and extreme environmental conditions. No postulated event results in damage to fuel, release of radioactivity, or danger to the public health and safety. All operational equipment will be maintained, tested, and operated according to the implementing procedures developed for the ISFSI. The failure or unavailability of any operational component can result in delay in transfer of the DSC to the HSM, but will not result in an unsafe condition.

Under normal operations, the ISFSI provides for independent storage of spent fuel away from the CCNPP facilities. With the exception of some limited physical and continuous electronic security surveillance, the facility functions as a passive system once fuel has been loaded. Loading of fuel assemblies into the facility, which occurs periodically, requires specific procedures that are separate from those of normal plant operations.

9.4.1 ADMINISTRATIVE CONTROLS

Existing and proposed CCNPP organizational and administrative systems and procedures, record keeping, review, audit, and reporting requirements are used to ensure that the operations involved in the storage of spent fuel at the Calvert Cliffs ISFSI are performed in a safe manner. This includes both the selection of assemblies qualified for ISFSI storage and the verification of assembly identification numbers prior to and after placement into individual storage canisters.

9.4.1.1 Qualification of Spent Fuel

Fuel assembly qualification is based on the requirements for criticality control, decay heat removal, radiological protection, and structural integrity. Fuel assembly reactivity, radiological source strength, and decay heat removal capabilities are defined by three variables: (1) the initial enrichment of the unirradiated fuel assembly, (2) the final assembly burnup at discharge, and (3) the out-of-reactor cooling time. Table 9.4-1 (Reference 9.15) presents the minimum cooling time for each fuel batch to achieve the 0.66 kW decay heat limit. Table 9.4-2 represents the acceptance criteria for minimum spent fuel burnup as a function of initial enrichment for the NUHOMS-24P DSC. The NUHOMS-32P DSC has no limit on minimum spent fuel burnup, but assemblies containing irradiated stainless steel replacement pins have additional acceptance criteria presented in Table 9.4-3. The administrative procedures controlling these variables are as described below.

Procedures currently in place for special nuclear materials (SNMs) accountability and record keeping are used to verify initial fuel assembly enrichment and burnup levels at discharge. New fuel enrichments and initial uranium isotopics are recorded from the Department of

Energy/Nuclear Regulatory Commission Form 741s and stored in both a database file and on duplicate paper copies of the Form 741s. Individual fuel assembly burnups are also stored in the SNMs database. These values are generated by utilizing thermal energy production data determined by in-core flux mapping. Burnup and initial enrichment values from the SNM accountability records of each IFA are compared to the applicable limits to verify that the reactivity level is acceptable for DSC loading and storage. The enrichment vs. burnup method for reactivity verification will routinely be used, and required by procedures, for the NUHOMS-24P DSC. Calvert Cliffs Nuclear Power Plant reserves the right to rely on other Nuclear Regulatory Commission accepted analytical methods to qualify fuel assemblies in special cases.

Subcriticality in the NUHOMS-32P DSC is assured by limiting the initial enrichment of unirradiated fuel assemblies to ≤ 45 wt% U-235, by the presence of fixed neutron absorbing plates in the basket assembly, and by the presence of soluble boron in the spent fuel pool water.

For decay heat control, only those irradiated assemblies which do not exceed a decay heat level of 0.66 kW qualify for loading into the DSC. Due to Co-60 production, assemblies with stainless steel replacement rods require additional cooling time beyond the time at which they reach 0.66 kW as shown in Table 9.4-3. Decay heat loadings at or below this level ensure that peak fuel rod cladding temperatures are maintained within acceptable levels. Since individual fuel assembly decay heat levels are a function of both the discharge burnup and the cooling time, procedural controls are used to verify these parameters prior to fuel assembly loading. For the Calvert Cliffs fuel design and operating histories, the cooling time necessary to achieve a 0.66 kW decay heat level is between 4 and 17 years. The variation in required cooling time is a very strong function of discharge burnup and a very weak function of initial enrichment. The cooling times of fuel discharged is presented in Table 9.4-1.

Specific qualification of the fuel assembly radiological source term is not necessary prior to fuel loading. Analysis shows that the reference source term used to generate the surface dose rate values found in Chapters 7 and 12 is not exceeded by any fuel assembly meeting the limiting conditions for cooling times specified in Table 9.4-1 and Table 9.4-3.

Therefore, assemblies that fall into the acceptance region of Table 9.4-2 qualify as candidates for ISFSI storage with the appropriate minimum cooling. Additional calculations relating reactivity (i.e., initial enrichment and discharge burnup) with decay heat and the required cooling time may be performed, as needed, to qualify future assemblies.

To ensure the structural integrity of the spent fuel to be loaded into the DSC, plant records of all known damaged assemblies are reviewed. A fuel assembly and component database has been compiled which incorporates previous sipping, ultrasonic testing, eddy current, and visual observation. This database is examined as a part of the dry storage qualification process to verify that assemblies with known cladding breaches are not included.

Fuel assemblies are also screened to ensure they conform to the requirements of Reference 9.14 to ensure the fuel assemblies with burnup < 47,000 MWD/MTU contain no more than two vacancies in any location within a column or row. This allows 28 vacancies per assembly with burnup < 47,000 MWD/MTU. The vacancies do not need to be adjacent to one another. The analysis finds fuel assemblies that conform to this configuration to be structurally sound under all anticipated conditions. Vacancies are restricted for fuel with burnup between 47,000 MWD/MTU and 52,000 MWD/MTU pending further structural analysis.

If the reactivity, decay heat, and structural integrity criteria are all met, then approval for dry storage for a given assembly is granted. This qualification is documented and subsequently referenced through ISFSI operating procedures prior to loading fuel into the DSC.

9.4.1.2 Spent Fuel Identification

Administrative controls will be utilized to avoid fuel misplacement. Information on fuel assembly qualification for dry storage will be documented and transmitted to fuel handling personnel. Prior to any transfer of a fuel assembly to the DSC, specific DSC loading procedures will require a review of assembly documentation. This will be followed by an independent visual verification of the assembly identification number. These procedures ensure that the correct (approved) fuel assembly is being accessed and loaded into the DSC. As a final check, all assembly identification numbers will be visually checked and recorded after the DSC has been fully loaded.

9.4.2 RECORDS

The ISFSI records are maintained in accordance with the requirements of 10 CFR Part 72. Procedures have been developed for use by the Spent Fuel Storage Project (SFSP) which meet the requirements of 10 CFR Part 72 for records retention during the construction phase of the project (Reference 9.5). Additional procedures have been developed to encompass the fuel loading and storage phases of the project.

For SNM accountability, the management system in place for Calvert Cliffs Units 1 and 2 has been expanded to allow record-keeping relative to storage of fuel at the ISFSI. The requirements of 10 CFR 72.72, 10 CFR 72.74, 10 CFR 72.76, and 10 CFR 72.78 have been met by adding the ISFSI to our current system, which meets the equivalent requirements of 10 CFR 70.51, 10 CFR 70.52, 10 CFR 70.53, and 10 CFR 70.54, respectively. Horizontal storage module and DSC identification numbers, along with individual assembly locations within a DSC, are maintained in our SNM database consisting of core locations, spent fuel pool rack locations, etc. In this way, ISFSI SNM accountability requirements are met. Periodic physical inventory requirements are met by verifying that HSMs have not been tampered with since the previous inventory (References 9.9 and 9.11).

While 10 CFR 70.51 imposes a three year duration of records storage, by maintaining the ISFSI records for ISFSI lifetime plus five years the duration requirement of 10 CFR 72.72 is met. It is the intention of CCNPP to use the existing system for maintaining records, ensuring that the stricter of the requirements of the various Parts of 10 CFR are met.

TABLE 9.4-1
POST-DISCHARGE COOLING TIME TO MEET 0.66 kW DECAY HEAT LIMIT*

NUHOMS-24P

INITIAL ENRICHMENT (W/O U^{235})	BURNUP (MWD/MTU)	COOLING TIME** (Years)
$4.00 < E \leq 4.50$	$B.U. \leq 47,000$	10
$3.50 < E \leq 4.00$	$45,000 < B.U. \leq 47,000$	11
	$42,000 < B.U. \leq 45,000$	10
	$B.U. \leq 42,000$	8
$3.00 < E \leq 3.50$	$45,000 < B.U. \leq 47,000$	12
	$42,000 < B.U. \leq 45,000$	11
	$B.U. \leq 42,000$	9
$2.50 < E \leq 3.00$	$45,000 < B.U. \leq 47,000$	13
	$42,000 < B.U. \leq 45,000$	12
	$39,000 < B.U. \leq 42,000$	10
	$B.U. \leq 39,000$	8
$2.00 < E \leq 2.50$	$45,000 < B.U. \leq 47,000$	15
	$42,000 < B.U. \leq 45,000$	13
	$39,000 < B.U. \leq 42,000$	11
	$B.U. \leq 39,000$	9

* All assemblies loaded into DSC must meet the source spectra requirements of Technical Specification 2.1.

** These bounding cooling times may be superceded with bundle specific cooling times via explicit bundle specific decay heat calculations.

TABLE 9.4-1
POST-DISCHARGE COOLING TIME TO MEET 0.66 kW DECAY HEAT LIMIT*

NUHOMS-24P

NUHOMS-32P COOLING TIMES** (Years)

Burnup (GWd/MTU) / Enrichment	B ≤ 38	38 < B ≤ 39	39 < B ≤ 40	40 < B ≤ 41	41 < B ≤ 42	42 < B ≤ 43	43 < B ≤ 44	44 < B ≤ 45	45 < B ≤ 46	46 < B ≤ 47	47 < B ≤ 48	48 < B ≤ 49	49 < B ≤ 50	50 < B ≤ 51	51 < B ≤ 52
2.00≤E<2.10	8.4	8.9	9.4+	9.9+	10.5+	11.2+	11.9+	12.6+	13.4+	14.3+	15.2+	16.2+	17.3+	18.5+	19.7+
2.10≤E<2.20	8.3	8.7	9.2	9.8+	10.4+	11.0+	11.7+	12.5+	13.3+	14.1+	15.1+	16.0+	17.1+	18.2+	19.4+
2.20≤E<2.30	8.1	8.6	9.1	9.6	10.2+	10.8+	11.5+	12.3+	13.1+	13.9+	14.9+	15.9+	16.9+	18.0+	19.2+
2.30≤E<2.40	8.0	8.5	9.0	9.5	10.1+	10.7+	11.4+	12.1+	12.9+	13.8+	14.7+	15.7+	16.7+	17.8+	19.0+
2.40≤E<2.50	7.9	8.4	8.8	9.4	9.9	10.6+	11.2+	12.0+	12.8+	13.6+	14.5+	15.5+	16.5+	17.7+	18.8+
2.50≤E<2.60	7.8	8.2	8.7	9.3	9.8	10.4	11.1+	11.8+	12.6+	13.5+	14.4+	15.3+	16.4+	17.5+	18.7+
2.60≤E<2.70	7.7	8.2	8.6	9.1	9.7	10.3	11.0	11.7+	12.5+	13.3+	14.2+	15.2+	16.2+	17.3+	18.5+
2.70≤E<2.80	7.6	8.1	8.5	9.0	9.6	10.2	10.9	11.6	12.4+	13.2+	14.1+	15.0+	16.1+	17.2+	18.3+
2.80≤E<2.90	7.6	8.0	8.4	9.0	9.5	10.1	10.8	11.5	12.2	13.1+	13.9+	14.9+	15.9+	17.0+	18.2+
2.90≤E<3.00	7.5	7.9	8.4	8.9	9.4	10.0	10.7	11.4	12.1	12.9	13.8+	14.8+	15.8+	16.9+	18.0+
3.00≤E<3.10	7.4	7.9	8.3	8.8	9.3	9.9	10.6	11.3	12.0	12.8	13.7	14.6+	15.7+	16.7+	17.9+
3.10≤E<3.20	7.4	7.8	8.2	8.7	9.3	9.8	10.5	11.2	11.9	12.7	13.6	14.5	15.5+	16.6+	17.7+
3.20≤E<3.30	7.3	7.7	8.2	8.7	9.2	9.8	10.4	11.1	11.8	12.6	13.5	14.4	15.4	16.5+	17.6+
3.30≤E<3.40	7.3	7.7	8.1	8.6	9.1	9.7	10.3	11.0	11.7	12.5	13.4	14.3	15.3	16.4	17.5
3.40≤E<3.50	7.3	7.6	8.1	8.5	9.1	9.6	10.2	10.9	11.6	12.4	13.3	14.2	15.2	16.2	17.4
3.50≤E<3.60	7.2	7.6	8.0	8.5	9.0	9.6	10.2	10.8	11.6	12.3	13.2	14.1	15.1	16.1	17.2
3.60≤E<3.70	7.2	7.6	8.0	8.4	8.9	9.5	10.1	10.8	11.5	12.3	13.1	14.0	15.0	16.0	17.1
3.70≤E<3.80	7.2	7.5	7.9	8.4	8.9	9.4	10.0	10.7	11.4	12.2	13.0	13.9	14.9	15.9	17.0
3.80≤E<3.90	7.1	7.5	7.9	8.3	8.8	9.4	10.0	10.6	11.3	12.1	12.9	13.8	14.8	15.8	16.9
3.90≤E<4.00	7.1	7.5	7.9	8.3	8.8	9.3	9.9	10.5	11.2	12.0	12.8	13.7	14.7	15.7	16.8
4.00≤E<4.10	7.1	7.4	7.8	8.2	8.7	9.3	9.8	10.5	11.2	11.9	12.7	13.6	14.6	15.6	16.7
4.10≤E<4.20	7.0	7.4	7.8	8.2	8.7	9.2	9.8	10.4	11.1	11.8	12.7	13.5	14.5	15.5	16.6
4.20≤E<4.30	7.0	7.4	7.7	8.2	8.6	9.1	9.7	10.3	11.0	11.8	12.6	13.4	14.4	15.4	16.5
4.30≤E<4.40	7.0	7.3	7.7	8.1	8.6	9.1	9.7	10.3	10.9	11.7	12.5	13.3	14.3	15.3	16.4
4.40≤E<4.50	7.0	7.3	7.6	8.1	8.5	9.0	9.6	10.2	10.9	11.6	12.4	13.2	14.2	15.2	16.2

\+ indicates that additional cooling time beyond that shown must be determined through an assembly specific source term calculation to ensure compliance with Technical Specification 2.1.

TABLE 9.4-2
NUHOMS-24P BURNUP CURVE DATA

INITIAL ENRICHMENT (W/O U^{235})	ACTUAL RESULTS (GWD/MTU)	4th ORDER CURVE FIT DATA[a] (GWD/MTU)
1.8	0.00	0.25
1.9	2.83	
2.	5.17	
2.1	7.28	
2.2	9.20	
2.3	10.73	10.95
2.4	12.56	
2.5	14.05	
2.6	15.45	
2.7	16.77	
2.8	17.65	18.03
2.9	19.25	
3.	20.44	
3.1	21.61	
3.2	22.78	
3.3	23.96	23.96
3.4	25.14	
3.5	26.33	
3.6	27.55	
3.7	28.79	
3.8	29.55	30.04
3.9	31.32	
4.	32.61	
4.1	33.91	
4.2	35.21	
4.3	36.37	36.50
4.4	37.77	
4.5	39.01	
4.6	40.20	
4.7	41.33	
4.8	42.11	42.38

NOTE:

Equation BU = A*X 4+B*X 3+3+C*X 2+D*X+E

Where A = -0.7521212
B = 10.9435555
C = -58.678357
D = 149.626326
E = 134.88247

[a] Fuel burnup in excess of the curve fit data as shown in the table or as calculated by the fourth-order polynomial lie within the acceptance region illustrated in Figure 3.3-1.

This table is not used for assemblies loaded into a NUHOMS-32P DSC.

TABLE 9.4-3
ADDITIONAL COOLING TIME REQUIREMENTS FOR LOADING ASSEMBLIES WITH IRRADIATED STAINLESS STEEL INERT REPLACEMENT RODS IN A 32P DSC

	# SS Pins Allowable by Years after 600W			
Max SS Pin Exposure MWD/MTU	0 Year	1 Year	2 Years	3 Years
20000	0	12	21	30
30000	0	7	13	18
40000	0	5	9	13

9.5 EMERGENCY PLANNING

The Emergency Response Plan (ERP) for CCNPP has been determined to be adequate for events which might occur involving the ISFSI. The ERP has been prepared in accordance with the requirements of 10 CFR 50.47, and therefore, satisfies the requirements of 10 CFR 72.32.

The CCNPP ERP has been developed to protect the general public and site personnel from possible consequences of an emergency condition. This plan, combined with its implementation procedures and the Radiological Emergency Plans of the state and local agencies, allows for (a) early recognition and classification of a possible emergency condition; (b) prompt notification, via reliable communication channels, of agencies and personnel to augment the normal operating personnel; (c) planned actions to be taken to protect the population-at-risk.

The CCNPP staff is trained to cope with emergencies. Written agreements with Federal agencies, private contractors, and coordinated state and local agency emergency plans (required by law) provide assistance to ensure resources can be readily available in as short a time as possible to cope with emergencies and protect the population-at-risk. The agencies, and the resources they will provide, are described in the ERP and the "Maryland Disaster Assistance Plan, Annex Q, Radiological Emergency Plan." Both plans describe the roles of the various state and local agencies and their interfaces for carrying out protective and parallel actions in a 10-mile-radius plume zone and a 50-mile-radius ingestion zone.

The ERP describes (1) the emergency classification system used at the plant; (2) the organizational control of emergencies, including on-site, off-site, and augmentation organizations; (3) the emergency measures to be taken; and (4) available emergency facilities and equipment.

Procedures for implementation of the CCNPP ERP are contained in the Emergency Response Plan Implementation Procedures.. These procedures are distributed to those individuals, and/or facilities where immediate availability of such procedures would be required during an emergency. The Emergency Response Plan Implementation Procedures provide the following information:

A. Means of classifying emergencies;

B. Lists of available equipment;

C. Directions for meeting notification requirements;

D. Directions for seeking emergency assistance;

E. Detailed instructions to individuals responsible for (a) assessing emergency conditions and (b) providing steps to be taken to mitigate the consequences of the accident.

The Emergency Response Plan Implementation Procedures are used in conjunction with applicable plant operating, radiological control, and security procedures to correct the emergency condition and to mitigate the consequences of the accident. Further details of the CCNPP ERP are contained in UFSAR Section 12.6.

9.6 DECOMMISSIONING PLAN

Decommissioning of the ISFSI will be performed in a manner consistent with decommissioning of the CCNPP. It is anticipated that the DSCs will be transported to a Federal repository when such a facility is operational. However, should the storage facility not accept the DSCs intact, the NUHOMS system allows the DSCs to be brought back into the spent fuel pool and the fuel repositioned into the racks for loading into transport casks provided by the Department of Energy.

All components of the NUHOMS system are manufactured of materials similar to those found at the existing CCNPP (e.g., reinforced concrete, stainless steel, lead). These components will be decommissioned by the same methods in place to handle those materials within the plant. Any of the components that may be contaminated will be cleaned and/or disposed of using the decommissioning technology available at the time of decommissioning.

Removal of fuel assemblies from the DSC can be done in the plant's spent fuel pool, as described in Chapter 5, or the DSC could also be qualified for off-site shipment in a suitable transportation cask licensed to 10 CFR Part 71. If such transport is made, the DSC could be disposed of as-is at the final spent fuel repository. If the DSC is not compatible with the final repository handling systems, fuel transfer to a suitable container can be performed in any suitable large hot cell or off-site fuel pool.

The detailed decommissioning plan for Calvert Cliffs ISFSI is provided in Reference 9.13.

9.7 REFERENCES

9.1 Calvert Cliffs Nuclear Power Plant, Updated Final Safety Analysis Report, Docket Nos. 50-317 and 50-318, Baltimore Gas and Electric Company

9.2 SFSP Procedure SFSPP-1, Preparation and Control of Spent Fuel Storage Procedures

9.3 SFSP Procedure SFSPP-2, Control of Changes and Deviations Found During Construction

9.4 SFSP Procedure SFSPP-4, Procurement

9.5 SFSP Procedure SFSPP-13, Records Retention

9.6 SFSP Procedure SFSPP-14, Nuclear Related Indoctrination, Training and Qualification

9.7 QAP-36, Independent Spent Fuel Storage Installation

9.8 10 CFR Part 72 Quality Assurance Program for the Spent Fuel Storage Project

9.9 Letter from Mr. G. C. Creel (BGE) to Director, Office of Nuclear Material Safety and Safeguards (NRC), dated December 20, 1990, Response to NRC's Comments on the Safety Analysis Report (SAR) for BGE's License Application for Calvert Cliffs Independent Spent Fuel Storage Installation (ISFSI)

9.10 Letter from Mr. G. C. Creel (BGE) to Director, Office of Nuclear Material Safety and Safeguards (NRC), dated September 30, 1991, Response to NRC's Follow Up Comments on the Safety Analysis Report (SAR) for BGE's License Application for Calvert Cliffs Independent Spent Fuel Storage Installation (ISFSI)

9.11 Letter from Mr. G. C. Creel (BGE) to Director, Office of Nuclear Material Safety and Safeguards (NRC), dated December 27, 1991, Response to Requests for Additional Information (RAI), Dated December 12 and 19, 1991, on the Safety Analysis Report (SAR) for BGE's License Application for Calvert Cliffs Independent Spent Fuel Storage Installation (ISFSI)

9.12 Letter from Charles H. Cruse (BGE) to Region I, Regional Administrator (NRC), dated October 19, 1993, Calvert Cliffs Nuclear Power Plant Independent Spent Fuel Storage Installation; Docket No. 72-8150-317/318, Preoperational Test Acceptance Criteria and Test Results

9.13 Letter from Mr. G. C. Creel (BGE) to Director, Office of Nuclear Material Safety and Safeguards (NRC), dated August 18, 1992, Revision to the ISFSI Decommissioning Plan

9.14 CCNPP Calculation No. CA06354, "Accidental Drop Loading Evaluation of 14x14 Fuel Assembly with Missing Fuel Rods"

9.15 CCNPP ES200600043, Implementation of ISFSI License Amendment No. 9 Prior to 2010 Loadings