U S. NUCLEAR REGULATORY COMMISSION

OFFICE OF NUCLEAR MATERIAL SAFETY AND SAFEGUARDS

ENVIRONMENTAL ASSESSMENT RELATED TO CONSTRUCTION AND OPERATION OF THE CALVERT CLIFFS INDEPENDENT SPENT FUEL STORAGE INSTALLATION

DOCKET NO 72-8 (50-317, -318)
BALTIMORE GAS AND ELECTRIC COMPANY

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RELATED TO THE CONSTRUCTION AND OPERATION

OF THE CALVERT CLIFFS

INDEPENDENT SPENT FUEL STORAGE INSTALLATION

1.0 INTRODUCTION

1.1 DESCRIPTION OF THE PROPOSED ACTION

By letter dated December 21, 1989, Baltimore Gas and Electric Company (the Applicant) submitted an application for a license to construct and operate a dry independent spent fuel storage installation (ISFSI) to be located on the Calvert Cliffs Nuclear Power Plant site in Calvert County, Maryland. The ISFSI or some other spent fuel storage system is needed in order to maintain a prudent operating reserve of spent fuel storage capacity in the two spent fuel pools at the Calvert Cliffs site. This Environmental Assessment (EA) addresses the expected environmental impacts associated with the proposed construction and operation of the ISFSI on the Calvert Cliffs Nuclear Power Plant site.

Baltimore Gas and Electric Company owns and operates two 2700 MWt nuclear generating units at the Calvert Cliffs Nuclear Power Plant. The proposed ISFSI will be located approximately 2300 feet southwest of the power plant about 70 feet above the existing plant yard elevation. Figure 1.1 shows the location of the proposed ISFSI relative to the other features on the site including the reactor buildings and security fence. Figure 1.2 provides additional detail on the ISFSI layout.

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

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

Security Related Information

Figure Withheld Under 10 CFR 2.390

Legend

Code	Description
	Existing Facilities
	Future Facilities
1	Old Chlorine Storage Building
2	Interim Office Building
3	Laydown Area
4	Trailer Site
5	Contractor Fabrication Shop
6	South Processing
7	Paint Storage Building and Sandblast Area
8	Warehouse One
9	Warehouse Two
10	Warehouse Three
11	Transportation Repair Facility and Fuel Island
12	Security Guard Post
13	Unit Number 1
14	Unit Number 2
15	Auxiliary Building
16	Turbine Building

Location of ISFSI

Calvert Cliffs Site Plan

Calvert County, Maryland

Prepared for: Baltimore Gas and Electric Company

Prepared by: Daft McCune Walker, Inc.

CS&D Cochran, Stephenson & Donkervoet, Inc.

Figure 1.1

Security Related Information

Figure Withheld Under 10 CFR 2.390

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Figure 1.2

ISFSI LAYOUT

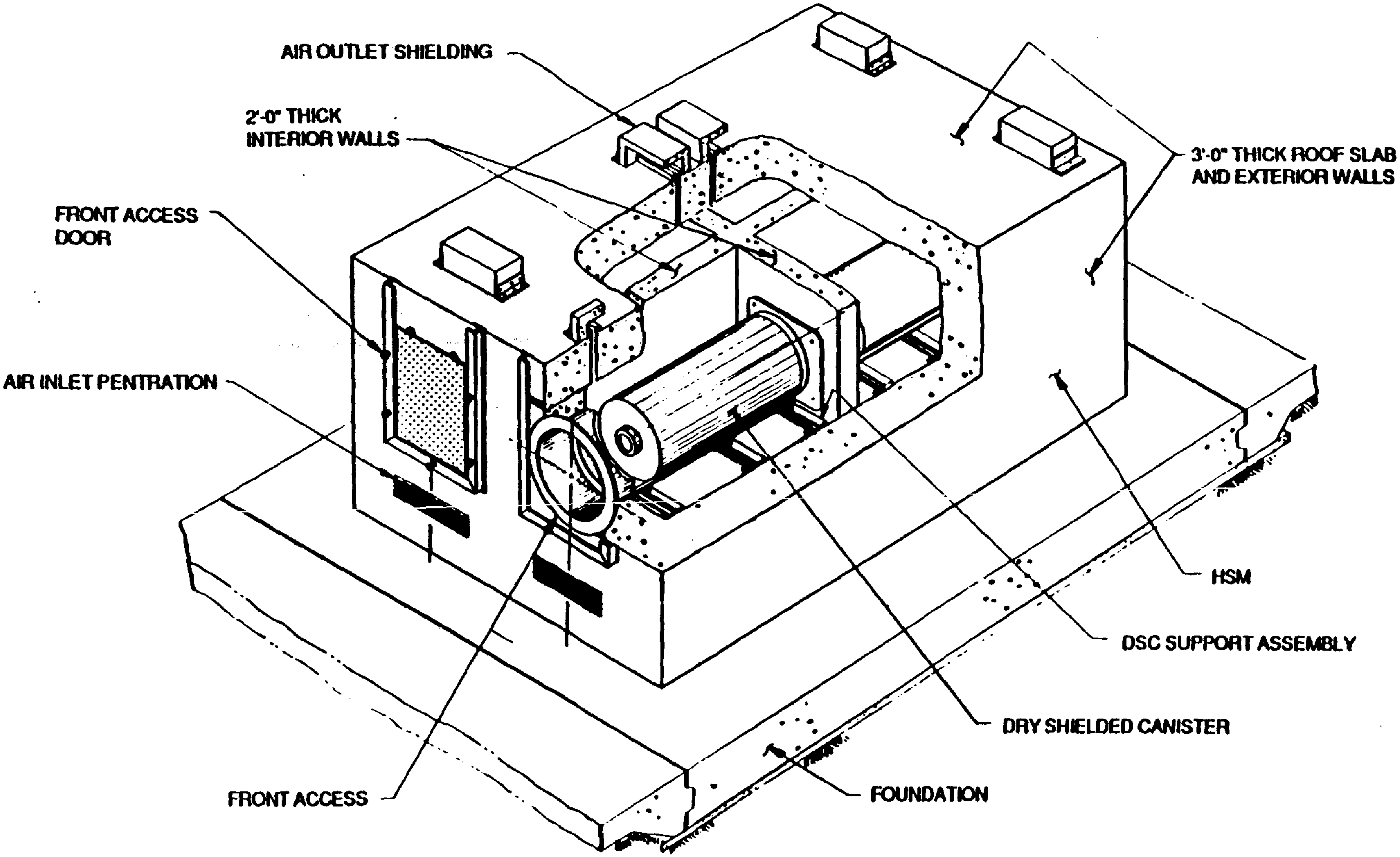

Figure 1.3

NUHOMS-24P HORIZONTAL STORAGE MODULE COMPONENTS

1.2 BACKGROUND INFORMATION

Both Calvert Cliffs units were granted their construction permits in November 1969. The first unit began commercial operation in May 1975. The second unit began commercial operation in April 1977. Prior to the mid 1970's, the nuclear industry in general and the Calvert Cliffs Nuclear Power Plant in particular, planned to store, for an interim period, spent fuel from nuclear power reactors in a spent fuel pool at the reactor site where it was generated. After an indefinite interim storage period, utilities anticipated that spent fuel would be transported to a reprocessing plant for recovery and recycling of fuel materials. Reactor facilities, such as the Calvert Cliffs units, were not designed to provide spent fuel storage capacity for life-of-plant operations.

Because commercial reprocessing did not develop as anticipated, the Nuclear Regulatory Commission (NRC), in 1975, directed the staff to prepare a generic environmental impact statement (EIS) on spent fuel storage. The Commission directed the staff to analyze alternatives for the handling and storage of spent fuel from light water power reactors with particular emphasis on developing long range policy. The staff also considered the consequences of restriction or termination of spent fuel generation through nuclear power plant shutdown. A "Final Generic Environmental Impact Statement (FGEIS) on Handling and Storage of Spent Light Water Power Reactor Fuel," NUREG-0575,[1] was issued by NRC in August 1979.

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

The FGEIS concluded that an ISFSI represents the major means of interim storage at a reactor site once the spent fuel pool capacity has been reached. The FGEIS supports findings that the storage of light water cooled power reactor (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. In the case of both dry passive storage and wet storage, environmental impacts need to be considered on a site-specific basis.

The onsite expansion of spent fuel pools has been used by most utilities. The NRC has reviewed and approved more than 120 onsite spent fuel pool capacity expansions through reracking modifications since issuance of the FGEIS. At the Calvert Cliffs Nuclear Power Plant, both spent fuel pools have been reracked increasing the pool capacity to its maximum. Design limitations preclude further expansion, thus eliminating this as a viable option for meeting increased storage needs.

Baltimore Gas and Electric Company, therefore, proposes to solve the problem of inadequate spent fuel storage capacity at its Calvert Cliffs Station through the construction of an onsite ISFSI. As required by 10 CFR Part 72, this assessment addresses the site-specific environmental impacts of construction and operation of the dry storage ISFSI at the Calvert Cliffs Nuclear Power Plant site.

1.3 PREVIOUS ENVIRONMENTAL ASSESSMENTS AND SUPPORTING DOCUMENTS

Several environmental documents have been prepared specific to the Calvert Cliffs Nuclear Power Plant site. A Final Environmental Statement (FES) related to the operation of the Calvert Cliffs Nuclear Power Plant was prepared by the U.S. Atomic Energy Commission in 1973.[2] This document relied on information supplied by Baltimore Gas and Electric Company in the its Environmental Report (ER) related to the proposed ISFSI for the Calvert Cliffs Nuclear Power Plant submitted with the application in December 1989[3] and supplementary information was submitted in response to NRC questions in October 1990.[4] This EA is tiered on the 1973 FES, the 1990 ER with supplementary information, and the FGEIS (NUREG-0575). Additional information used in this assessment is provided in the applicant's Final Safety Analysis Report (SAR) for the operation of the Calvert Cliffs Nuclear Power Plant,[5] the SAR for the proposed ISFSI[6], and the Nutech, Inc., "Topical Report for the Nutech Horizontal Modular Storage System for Irradiated Nuclear Fuel: NUHOMS-24P."[7]

2.0 NEED FOR PROPOSED ACTION

The two spent fuel pools at the Calvert Cliffs Nuclear Power Plant are shared between Units 1 and 2. The combined capacity of the two pools was originally 400 storage positions, but with the reracking efforts, the capacity of the pools has been increased to 1830 storage positions. Design limitations preclude any further pool storage capacity increases.

Prudent operating practice provides for sufficient spent fuel storage capacity to accommodate a full core off-load (217 assemblies), and allows safe diver access for maintenance during a refueling outage. The prudent operating reserve for the Calvert Cliffs pools will be lost in April 1993. The ability to offload an entire reactor core will be lost in April 1995.

Additional spent fuel is being generated as the units continue to operate, and additional storage capacity will be required in order to recover and maintain the prudent operating reserve of spent fuel storage capacity. The proposed action would provide the additional capacity required to store spent fuel expected to be generated at the Calvert Cliffs Nuclear Power Plant through 2016, the end of its currently licensed operating life, if needed.

3.0 ALTERNATIVES

Baltimore Gas and Electric Company evaluated a number of alternatives for the storage of spent nuclear fuel prior the selection of the dry storage ISFSI. The alternatives did not sufficiently meet the requirements for storage of spent nuclear fuel generated at the Calvert Cliffs Nuclear Power Plant. A brief discussion of these alternatives follows.

Permanent Federal Repository

If a permanent Federal repository were available, the preferred alternative would be to ship spent fuel to the repository for disposal. The Department of Energy (DOE) is currently working to develop a repository as required under the Nuclear Waste Policy Act (NWPA), but is not likely to have a licensed repository ready to receive spent fuel before 2010. Although the Department of Energy recommended that a Monitored Retrievable Storage (MRS) facility be constructed and in operation by 1998, the NWPA prohibits siting an MRS before obtaining a construction permit for the repository. Given the uncertainties of schedules for a repository and MRS, this alternative, therefore, does not meet the near-term storage needs of the Baltimore Gas and Electric Company.

Reracking of the Calvert Cliffs Spent Fuel Pools

As discussed in Section 1.2, by reracking the spent fuel pools at the Calvert Cliffs Nuclear Power Plant, the pools have reached their maximum capacity.

Transshipment to other Nuclear Reactor Sites

Because of uncertainties in the timing of fuel acceptance for Federal storage and disposal under the Nuclear Waste Policy Act, most utilities are expected to face spent fuel storage shortfalls and are expected to be unwilling to reduce their own storage capacity. Therefore, this option is not considered to be viable.

Full Scale Rod Consolidation

Baltimore Gas and Electric Company has been involved in the development of fuel rod consolidation. While disassembling the intact fuel assemblies and reconfiguring the fuel rods into a close packed array in the existing pool could expand storage capacity, it would only extend full core reserve capabilities to the year 2002. However, this alternative appears less attractive than that of the ISFSI because of technology uncertainties, current consolidation rates, potentially higher worker radiation exposure, and uncertainties about DOE acceptance of non-fuel bearing components that would be generated by consolidation.

Construction of a New Independent Storage Pool

Additional storage capacity could be achieved by building a new spent fuel storage pool similar to that existing at the plant site. The NRC has generically assessed the impacts of this alternative and found that "the storage of LWR spent fuels in water pools has an insignificant impact on the environment."[1] In contrast with the proposed action, the higher costs for commissioning, operating, maintaining, and decommissioning a new pool storage facility make this alternative less preferable.

Other Dry Storage Technologies

Other dry spent fuel storage, technologies such as metal casks, concrete casks, and modular dry vault storage, could provide additional storage capacity. These other technologies would be expected to have no significant environmental impact similar to that for the proposed action. However because of uncertainties and cost differentials these other technologies were not considered acceptable to BG&E.

Shipment to a Reprocessing Facility

There are no existing commercial reprocessing facilities in the United States, nor is there the prospect for one in the foreseeable future. While there are reprocessing facilities in operation in the United Kingdom, Japan, Germany, and France, in the near term, the political, legal and logistical uncertainties associated with trying to ship spent fuel overseas make this alternative not viable.

No Action

If no action were taken to provide additional spent fuel storage capacity, the Calvert Cliffs Nuclear Power Plant will be unable to continue operation beyond 1995. This would result in the elimination of 20 years of facility operation. the impacts of curtailing the generation of spent fuel by ceasing operation of existing nuclear power plants when their spent fuel pools become filled was evaluated and found to be undesirable.[1]

4.0 ENVIRONMENTAL INTERFACES

The general environment around the Calvert Cliffs Nuclear Power Plant is well characterized as a result of the studies conducted in support of construction of the Calvert Cliffs Nuclear Power Plant. This section briefly reviews the environment with emphasis on those environmental features that are most likely to be affected by the construction and operation of the ISFSI. The assessment of construction and operational impacts is presented in Chapter 6.

4.1 SITE LOCATION, LAND USE AND TERRESTRIAL RESOURCES

The proposed ISFSI will be located within the existing plant site area for the Calvert Cliffs Nuclear Power Plant. The area is wooded with Virginia and Loblolly Pines. The total storage area associated with the full 120 modules is estimated to be 676 feet by 236 feet. There will be a access 30-feet wide access off an existing road which leads from the developed portion of the site to the proposed ISFSI storage area. The total area developed for the ISFSI will be slightly more than 6 acres within the 2300 acre Calvert Cliffs site.

The Calvert Cliffs site is located in Calvert County, Maryland, on the west bank of the Chesapeake Bay. It is approximately 10.5 miles (17 km) southeast of the town of Prince Frederick, Maryland, at 38.4 degrees north latitude and 76.5 degrees west longitude.

Baltimore Gas and Electric Company owns and controls all property within a exclusion area with a minimum radius of 0.71-mile (from the center of Calvert Cliffs Units 1 & 2). Maryland Routes 2 and 4 run adjacent to the site on the west. The ISFSI will be located approximately 2,300 feet (701 m) southwest of the reactor buildings, placing it approximately 3,900 feet or 0.74 miles (1.2 km) from the controlled boundary in the west direction.

The ecology of the Calvert Cliffs site is well documented as a result of surveys performed for the operation of the nuclear power plant.[2] There are two species of endangered Tiger Beetles found along the beach area at Calvert Cliffs. Also, another endangered species, the Star Duckweed, is found on BG&E property. The ISFSI is located well outside of a 1200 foot protection zone, established by the State of Maryland, for a nest of Bald Eagles located south of Camp Conoy. Because the area proposed for the ISFSI is small (only about six acres), the surrounding area is already disturbed and the ISFSI has a fence surrounding it, there is expected be minimal effect on wildlife.

Within a 10-mile radius of the site, most of the land is predominantly rural and characterized by farmlands and wetlands. The Patuxent Naval Air Station is the only nearby military facility and is located ten miles south of the ISFSI. The are two other small airports in the area. The Chesapeake Ranch Airport is about 6 miles southeast of the ISFSI and the St. Mary's County Airport, located about 10 miles southwest. The only industrial facility within ten miles is the Cove Point Liquid Natural Gas (LNG) terminal and pipeline located 3.5 miles south-southeast of the Calvert Cliffs power plant. The LNG terminal has been idle since April 1981, but is scheduled to be reopened in 1991.

4.2 WATER USE AND AQUATIC RESOURCES

The ISFSI is located approximately 3,000 feet west of the western shore of the Chesapeake Bay. The Bay is used for recreational fishing, boating and swimming. The Bay is also an important fisheries resource and navigational shipping channel. Most potable water used in Calvert County is from subsurface sources and used chiefly for domestic and agricultural purposes. There are 15 towns and 8 private communities in Calvert County that have public water supplies. Most domestic water supplies in Calvert County come from deep wells. There are about 70 of these within 2 miles of the Calvert Cliffs plant.

4.3 SOCIOECONOMICS, AND HISTORICAL, ARCHEOLOGICAL, AND CULTURAL RESOURCES

The immediate area surrounding the Calvert Cliffs plant site is rural. Despite an average 5.2 percent annual population growth in Calvert County between 1970 and 1980 and a projected 75 percent increase between 1980 and 2010, no significant industrialization is expected and the socioeconomic character of the area will remain basically unchanged. The additional work force required during construction will not be of sufficient size or their stay of sufficient duration to affect the basic socioeconomic characteristics of the local area.

The ISFSI site is located within the Calvert Cliffs plant boundary and therefore will not affect any regional historic, archeological, cultural, or scenic resources.

4.4 DEMOGRAPHY

The population density in the vicinity of the Calvert Cliffs Nuclear Power Plant is generally low. There are currently no residences within 1 mile of the reactor plant. The closest residence is about 0.9 miles west-southwest of the ISFSI or about 1.3 miles southwest of the reactor plant. Additional residences are located within 1 to 2 miles from the west-northwest sector and west around to the southeast sector. In the future, the nearest resident might be located as close as 0.75 miles from the ISFSI which is the closest distance to the controlled area boundary.

A little over 300 people are estimated to live within 2 miles of the site and about 5500 people within 5 miles. Due to the recreational uses of the Chesapeake Bay in the area, the summer transient population may increase by about 23 percent. Nearby population centers within 5 miles of the site are as follows: Long beach, Calvert Beach, St. Leonard, Wallville, Mackall, Sellers, Lusby, Appeal, Bertha, and Cove Point.

The Tri-County Council of Southern Maryland has projected about a 75 percent increase in the population in the area between 1980 and 2010. Solomons, St. Leonard, and Longbeach communities are projected to be the major growth areas within 10 miles of the site.

4.5 METEOROLOGY

The Calvert Cliffs site lies along the west bank of the Chesapeake Bay. The Bay area generally has mild winters and summers. Most of the weather comes from a westerly direction across the United States. From October to April the winds prevail from the northwest and during the warmer months from the southwest, with average annual wind speeds of 4.7 mph. Precipitation amounts are distributed rather uniformly throughout the year, with typical amounts of about 40 inches annually. Additional climatological data is available in the ER.[3]

Extremes of weather include maximum wind speeds of 80 miles per hour recorded at the Baltimore-Washington International Airport, Maryland. Extremes in temperature have ranged from -3 to 103 degrees Fahrenheit at Patuxent River Naval Air Station. The heaviest monthly rainfall recorded at the Patuxent River Naval Air Station was 15.5 inches in July 1945. The heaviest monthly snowfall recorded was 32.3 inches in 1979.

The area experiences about 54 thunderstorms per year, and tropical storms may at times affect the area. Hurricane force winds are expected to affect the Calvert Cliffs area about once every 10 years. bring heavy rainfall to the region, with amounts of 5 to 6 inches falling within a 24-hour period.

The mean annual frequency of tornadoes in the vicinity of a single latitude-longitude square near the ISFSI is 0.5 per year and the probability of a tornado striking a single point within the area is approximately 3.75×10^{-4} tornadoes per square mile per year (or a recurrence frequency of about one tornado per square mile every 2700 years).[5]

4.6 GEOLOGY AND SEISMOLOGY

The Calvert Cliffs Nuclear Power Plant Site is located within the Coastal Plain Physiographic Province about 50 miles east of the Fall Zone. The regional geology is typical of the Piedmont Province. The buried surface of the basement igneous and metamorphic rock slopes to the southeast at about 50 feet per mile, and at the site, is located about 2500 feet below sea level. Beneath the Coastal Plain Province overlying the basement are Cretaceous and Tertiary strata consisting of sedimentary deposits of silt, clay, sand, and gravel. The thick sedimentary strata of the Coastal Plain in the vicinity of the site have essentially not been deformed since they were deposited about 135 million years ago. Areas in the vicinity of the site above 70 feet elevation are underlaid by Pleistocene age sediments which consist primarily of silt and sand. Portions of the site below 70 feet elevation are underlaid by relatively impervious Miocene age sediments of the Chesapeake group. Based on test borings at the ISFSI site and laboratory tests no significant potential for liquefaction of soils is anticipated.

The Calvert Cliffs site is in a region which has experienced infrequent minor earthquake activity. Because the region has been populated for over 300 years, all earthquakes of moderated intensity (Modified Mercalli Scale VI) or greater would probably have been reported during this period. Since the late 18th Century, 18 earthquakes with epicenter intensities ranging from Modified Mercalli Scale V to VII were reported within about 100 miles of the site. Most of the reported earthquakes in the region have occurred in the Piedmont Physiographic Province west of the Fall Zone and were generally related to known faults in the Piedmont rocks. No shock within 50 miles of the site has been large enough to cause significant structural damage. Only one earthquake of intensity V or greater, located 45 miles northeast of the site, has been reported but caused no structural damage.

5.0 DESCRIPTION OF THE CALVERT CLIFFS NUCLEAR PLANT ISFSI

5.1 GENERAL DESCRIPTION

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

5.2 ISFSI DESIGN

The ISFSI provides for the horizontal, dry storage of irradiated fuel assemblies in a concrete module. There are six major physical components associated with the proposed ISFSI. These are the spent fuel, the dry shielded canister (DSC), the transfer cask, the transfer trailer, the horizontal storage module (HSM), and the hydraulic ram. Each of these components is discussed below. Detailed design information is presented in Reference 6.

Spent Fuel

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

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

Dry Shielded Canister

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

Transfer Cask

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

Table 5.1. Design Parameters for the Calvert Cliffs ISFSI

Category	Criterion or Parameter	Value
Fuel Acceptance Criteria	Initial Fissile Content	1.8-4.5% ^{235}U with credit for burn-up
	Radiation Source	
	Total Gamma per Assembly	4.27×10^{15} photons/sec
	Total Neutron per Assembly	2.32×10^{8} neutron/sec
	Heat Load per Assembly	0.66 Kw
Dry Shielded Canister	Capacity per Canister	24 PWR Fuel Assemblies
	Size	
	Length (typical)	4.42 m (174 in.)
	Diameter	1.71 m (67 in.)
	Temperature (max. long-term fuel rod clad)	332 degrees C (630 degrees F)
	Cooling	Natural Convection
	Design Life	50 Years
	Material	304 Stainless Steel with Lead End-Shields
	Internal Helium	2.5 psig ± 2.5 psig
Horizontal Storage Module	Capacity	1 Dry Shielded Canister per Module
	Size	
	Length	5.8 m (19 ft.)
	Height	4.6 m (15 ft.)
	Width	2.6 m (8.7 ft.)
	Average Surface Radiation Dose Rate (area weighted average)	15 mrem/hr
	Material	Reinforced Concrete
Design Life		50 years

Transfer Trailer

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

Horizontal Storage Module

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

Hydraulic Ram

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

5.3 ISFSI OPERATIONS

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

Preoperational Testing

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

Component Quality Assurance

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

Fuel Selection

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

Contamination Control of the DSC Exterior Surfaces

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

Table 5.2. Major operational steps for tranferring the fuel from the Spent Fuel Pool to the ISFSI (1)

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

(1) Steps for removing the fuel from the DSC are not addressed above, but are considered in References 3 and 8.

Radiation Protection Procedures

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

Training

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

Normal and Emergency Procedures

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

5.4 MONITORING PROGRAM

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

The Calvert Cliffs Nuclear Power Plant maintains an air, water, and food pathway monitoring program which establishes the basis for evaluation of environmental impacts of facility operation, and is used in the assessment of public and occupational dose from Calvert Cliffs operations. This environmental surveillance program has been conducted continuously at the Calvert Cliffs Nuclear Power Plant since 1969. The program is designed to confirm that Baltimore Gas and Electric Company operations are within regulatory requirements and consistent with the documented As Low As Is Reasonably Achievable (ALARA) program. The main thrust of the health physics and ALARA programs is to minimize exposure to radiation such that the total exposure to personnel in all phases of design, construction, operation and maintenance are kept ALARA. The ISFSI operations are included in the existing ALARA program for the Calvert Cliffs Nuclear Power Plant.

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

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

Monitoring program results are published annually. The ongoing monitoring program is described and results for the most recent 1-year program are contained in Reference 8.

6.0 ENVIRONMENTAL IMPACTS OF THE PROPOSED ACTION

6.1 CONSTRUCTION IMPACTS

The ISFSI site area will be developed and managed so as to minimize construction impacts. All construction activities will comply with Federal, State and local regulations governing safety and health for construction. Work will be monitored by Baltimore Gas and Electric Company personnel.

Construction will be phased according to need. Initial requirements for storage will be met by construction of two 2 by 6 HSM arrays placed end to end. Subsequent construction of HSMs will be as required.

6.1.1 Land Use and Terrestrial Resources

The 120 storage modules and their access area will occupy about 6 acres (0.02 km^2) approximately 2300-feet (701 m) southwest of the reactor containment buildings. The area is totally within the Calvert Cliffs controlled area; thus, no additional land use impacts will result from construction of the ISFSI. Part of the construction area is wooded and will be cleared. The terrain alteration, clearing, excavation and grading will result in a loss of biological production of less that one percent of the Calvert Cliffs site area.

Construction of the ISFSI is not expected to have any impact on any known species listed by either the Federal or State government as endangered.

Measures will be taken to ensure that dust created during earthwork will be kept at an acceptable level and existing paved roads remain free of objectionable amounts of earth and rocks. Burning permits will be obtained as needed and requirements for erosion control, such as silt fences, used as necessary.

6.1.2 Water Use and Aquatic Resources

Construction of the ISFSI will not impact local water supplies. Concrete for the slab will arrive on the site ready-mixed. Drinking water for cleaning operations and fugitive dust control (spraying) will be transported to the site by truck. The portable rest rooms provided during construction require no onsite source of water . During clearing, and excavation operations, temporary measures will be utilized to manage storm-water runoff and provide sediment control in accordance with local construction codes. More permanent drainage will be installed as soon as area excavations and backfill allow.

6.1.3 Other Impacts of Construction

<u>Air Quality</u>

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

Noise

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

6.1.4 Socioeconomics

Construction of the Calvert Cliffs ISFSI is anticipated to be performed by a local contract construction firm and existing BG&E personnel. The size of the construction work force is not expected to exceed 50 persons at any one time. The Calvert Cliffs work force may be increased by at most two employees associated with ISFSI-related operations. Given the large population growth rate of Calvert County, a small number of new residents due to the ISFSI will have no effect on the community.

6.1.5 Radiological Impacts from Construction

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

6.2 OPERATIONAL IMPACTS

6.2.1 Radiological Impacts from Routine Operations

The primary pathway through which site workers and nearby residents may be exposed as a result of normal Calvert Cliffs ISFSI operations is through external exposure to direct and scattered radiation. Radiological dose estimates were calculated for this pathway using conservative and design basis assumptions: maximum storage module surface dose rates of 21 mrem/hr neutron and 47 mrem/hr gamma; maximum fuel burn-up of 42 GWD/MTU (gigawatt-days per metric ton of uranium); and post-irradiation decay period of at least 8 years before dry storage. These assumptions result in conservative dose estimates; actual doses are expected to be somewhat lower. Because the proposed ISFSI involves only dry storage of spent nuclear fuel in dry, sealed DSCs, there will be essentially no gaseous or liquid effluents associated with normal storage operations. Activities associated with cask loading and decontamination may result in some gaseous and liquid effluents; however, these operations will be conducted under the 10 CFR Part 50 operating license, and radiological impacts from those effluents fall within the scope of impacts from reactor operations which were assessed in the Calvert Cliffs FES.[2]

6.2.1.1 Offsite Dose

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

The maximally exposed member of the public is assumed to have continuous occupancy in the nearest residence to the ISFSI which is located 4705 feet from the facility. At that location, the dose rate from 120 HSMs filled to capacity with design basis fuel would be less than 1 mrem/yr from ISFSI, and less than 13.5 mrem/yr from the remaining fuel cycle operations in the vicinity.[4] It can be concluded that the radiation exposure due to the Calvert Cliffs ISFSI, combined with all other fuel cycle operations, will not exceed the regulatory requirements of 25 mrem/yr in 10 CFR 72.104 and 40 CFR Part 190.

Appendix I to 10 CFR 50 sets forth design objective dose commitment guides for liquid and gaseous effluents released from nuclear power reactors. For each reactor, the maximum annual dose commitment to an individual in an unrestricted area is 3 mrem/yr due to liquid effluents and 5 mrem/yr due to gaseous effluents. Thus, the maximum design guide dose commitment from effluents due to operations of Calvert Cliffs Units 1, 2 would be 16 mrem/yr. Current dose levels as a result of releases of radioactivity in effluents are less than the design level.

Since no liquid or airborne effluents are postulated to emanate from the ISFSI, the direst and air scattered radiation exposure discussed in the previous sections comprises the total radiation exposure to the public. No estimation of effluent dose equivalents is necessary.

The nearest resident is located 4705 ft. (1.4 km) from the ISFSI center. The maximum expected dose to an individual at this location would be about 0.2 mrem/yr. When combined with the dose commitment from reactor operations, the total dose commitment is well within the 25 mrem/yr limit specified in 10 CFR 72.104. In addition, trees and hilly terrain between the ISFSI and these locations provide shielding, such that individuals here would essentially be exposed only to air-scattered radiation from the ISFSI.

By 2010 there are projected to be about 492 people between 1 and 2 miles of the Calvert Cliffs Station. The collective dose to this population due to Calvert Cliffs ISFSI operations is estimated to be less than about 75 person-mrem/yr. The collective dose commitment to that same population due to Calvert Cliffs reactor operations without the ISFSI is estimated to be about 101 person-mrem/yr.[2] For populations in the region under consideration beyond 2 miles from the ISFSI, direct and air-scattered radiation contribute very little to the collective dose commitment.

6.2.1.2 Collective Occupational Dose

Spent fuel storage at the Calvert Cliffs ISFSI will result in a small increase in the total occupational dose at the Calvert Cliffs site. Occupational radiation exposure for ISFSI operations is expected to result from loading fuel into the DSC, loading the shipping cask, moving the shipping cask to the ISFSI, inserting the DSC into the HSM, sealing the HSM, and conducting routine security checks and operational surveillance. Occupational doses to construction workers result from exposure to direct and scattered radiation from irradiated fuel in previously filled modules. The license application requests authority to construct and operate a total of 120 HMSs. These modules will be built incrementally in 1 to 5 rows of 24 HMSs per row as needed to match the requirements for additional storage. Construction work performed subsequent to the loading of any HSM with spent fuel may result in work exposures from direct and skyshine radiation in the vicinity of the loaded HSMs. Assuming a maximum dose rate of 0.11 mrem/hr and a workforce of 1500 person hours per HSM, a total dose of 0.17 person-rem per HSM is estimated for occupational exposure resulting from construction activities. Assuming 24 HSMs are constructed and loaded with spent fuel initially, a total of about 4 person-rem is estimated for the occupational exposure associated with construction activities of each additional row of storage modules. This exposure would be received over the life of the plant. Calvert Cliffs Station workers not directly involved in ISFSI operations will be exposed to small increases in the general area radiation level.

Engineered features of the storage modules and application of administrative controls are designed to ensure that all exposures are maintained at levels which are As Low As Is Reasonably Achievable (ALARA). All ISFSI operations will be conducted under either (1) existing procedures suitably modified and approved for this activity, or (2) procedures to be prepared under the existing Baltimore Gas and Electric Company administrative requirements which meet NRC Quality Assurance (QA) and ALARA requirements. Occupational doses will be controlled to within the limits of 10 CFR Part 20.

Table 6.1 presents the estimated maximum collective occupational doses from annual operation and construction of the ISFSI, while Table 6.2 estimates the annual collective dose to Calvert Cliffs Station workers not directly involved in ISFSI activities.

A maximum of sixteen DSCs/HSMs are planned to be loaded the first year. The upper bound for annual ISFSI occupational exposure is estimated as follows.

1. The maximum occupational dose due to the loading of one DSC/HSM is about 1.5 person-rem.

2. The maximum occupational dose during the loading one DSC/HSM due to previously loaded HSMs is about 0.02 person-rem.

3. The maximum occupational dose during the loading of one DSC/HSM to the additional support personnel is about 0.02 person-rem.

Based on these results, the maximum occupational exposure due to the loading of the DSC/HSM is about 1.5 person-rem. This will result in a maximum annual ISFSI occupational dose during DSC/HSM from loading the first 16 DSC/HSMs of about 24 person-rem.

The dose to Calvert Cliffs Station workers not directly involved in ISFSI activities is expected to be about 16 person-rem/yr. These values constitutes a small, incremental fraction of the total occupational dose commitment at the Calvert Cliffs Nuclear Power Plant. During the years 1987, 1988, and 1989, the collective total occupational dose at Calvert Cliffs was 413 rem, 291 rem, and 346 person-rem respectively. The 3-year average from reactor operations is 350 person-rem.

Once all 120 modules are loaded, the annual occupational collective dose would be less than five percent of the current average occupational collective dose.

6.2.2 Radiological Impacts of Accidents

A variety of accident scenarios which may affect the safe operation of the Calvert Cliffs ISFSI have been postulated. These include earthquakes, tornadoes, tornado missiles, lightning, fires, pressurization of the DSC, blockage of air inlets and outlets, cask drop, leakage of the DSC, and loss of air outlet shielding. The canisters and storage modules are designed to withstand the resultant forces from these accidents. However, two of the postulated accidents have possible offsite radiological consequences. These are loss of air outlet shielding and canister leakage. Of these, canister leakage is the bounding case accident. For assessment purposes, an accident is postulated wherein a non-mechanistic simultaneous failure of the DSC and all fuel cladding occurs, resulting in the loss of the helium cover gas and 30 percent of the radioactive Kr-85, I-129, and H-3 inventory in the spent fuel for one DSC. Tables 6.3 and 6.4 summarize the radiological impact of this DSC accident scenario. The release fraction estimates for particulate radioactivity (i.e., Sr-90, Ru-106, Cs-137, and Cs-134) used in this analysis were based on a worst-case scenario for air-cooled transfer casks.[9] This reference (Scenario 5), while not directly relatable to a non-mechanistic simultaneous failure of the DSC, is expected to provide a reasonable assumption. Further, this reference clearly indicates that particulate releases contribute an insignificant amount to the radiation dose. The cited scenario considers all release mechanisms that are credible for air-cooled casks. Once radionuclides have been released from the fuel rods they are postulated to escape the DSC. The radioactivity released to the DSC cavity is based on the design fuel to be stored in the cask (PWR fuel, initial enrichment of 4.0 percent U-235; 42 GWD/MTU burn-up; 8 years out of the reactor). The accident damage is not expected to provide a pathway with a large cross-sectional area from the DSC cavity to the environment; the most likely release pathway would consist of only a small section of a failed DSC. In addition to the small release area, radionuclides can condense, plate out, or be filtered out before escaping the DSC.

Table 6.1 Collective occupational dose to Calvert Cliffs on workers directly involved in ISFSI activities

Operation	Person-rem per DSC	Person-rem per year
DSC Loading and Cask Decontamination at Reactor Transfer of DSC to and Emplacement in HSM	1.471	23.536(1)
Surveillance during loading	.0174	.278
Annual Surveillance		.046(2)
Total		23.860

(1) Estimates are based on the following assumed construction and loading schedule: 24 HSMs are constructed initially, and 16 DSCs are loaded the first year.

(2) This value is derived by assuming that one inspector performs a daily inspection walking at an average speed of 3 mph on a path passing directly in front of all 120 air vents of the ISFSI.

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

Location	No. of employees	Dose rate (mrem/hr)	Annual dose (person-rem/yr)
Office and Training Facility	240	1.2 E-03	0.75
Nuclear Engineering Facility	280	2.2 E-03	1.60
Materials Processing Facility	240	2.2 E-03	1.37
Nuclear Office Facility	470	4.7 E-03	5.74
Inside the Protected Area	1200	2.2 E-03*	6.86
Total			16.32

*Nuclear Engineering Facility dose rates used as conservative estimate for the plant protected area.

Table 6.3 Expected dose at the controlled area boundary resulting from a dry shielded canister leakage accident at the Calvert Cliffs Nuclear Power Plant (1)

Whole Body Dose

Nuclide	DSC inventory (uCi)	Release fraction	X/Q (sec/m^3)	Breathing rate (m^3/sec)	Tot. body inhalation DCF[10] (rem/uCi)	Dose at boundary (rem)
H-3	5.79E+09	3.00E-01	4.80E-04	2.54E-04	1.20E-04	2.54E-02
Kr-85	6.61E+10	3.00E-01	4.80E-04	1.00E+00	3.34E-10 (2)	3.18E-03
I-129	3.92E+05	3.00E-01	4.80E-04	2.54E-04	1.80E-01	2.58E-03
Cs-134	1.43E+11	5.00E-10	4.80E-04	2.54E-04	4.40E-02	3.84E-07
Cs-137	1.07E+12	5.00E-10	4.80E-04	2.54E-04	3.00E-02	1.96E-06
Sr-90	7.38E+11	5.00E-10	4.80E-04	2.54E-04	1.30E+00	5.85E-05
Ru-106	2.09E+10	5.00E-10	4.80E-04	2.54E-04	4.70E-01	5.99E-07
					Total Dose	0.031

Thyroid Dose

Nuclide	DSC inventory (uCi)	Release fraction	X/Q (sec/m^{3}s)	Breathing rate (m^3/sec)	Thyroid inhalation DCF[10] (rem/uCi)	Dose at boundary (rem)
H-3	5.79E+09	3.00E-01	4.80E-04	2.54E-04	1.20E-04	2.54E-02
Kr-85	6.61E+10	3.00E-01	4.80E-04	1.00E+00	3.34E-10 (2)	3.18E-03
I-129	3.92E+05	3.00E-01	4.80E-04	2.54E-04	8.30E+00	1.19E-01
Cs-134	1.43E+11	5.00E-10	4.80E-04	2.54E-04	7.70E-02	6.71E-07
Cs-137	1.07E+12	5.00E-10	4.80E-04	2.54E-04	4.90E-02	3.19E-06
Sr-90	7.38E+11	5.00E-10	4.80E-04	2.54E-04	9.50E-03	4.27E-07
Ru-106	2.09E+10	5.00E-10	4.80E-04	2.54E-04	6.10E-02	7.77E-08
					Thyroid Dose	0.148

(1) The distance from the controlled area boundary to the nearest HSM is about 3,900 feet.

(2) Whole-body submersion DCF in rem-m^3/uCi-sec (Reference 11).

Table 6.4 Expected dose at the nearest residence resulting from dry shielded canister leakage accident at the Calvert Cliffs Nuclear Power Plant(1)

Whole Body Dose

Nuclide	DSC inventory (uCi)	Release fraction	X/Q (sec/m^3)	Breathing rate (m^3/sec)	Tot. body inhalation DCF[10] (rem/uCi)	Dose at boundary (rem)
H-3	5.79E+09	3.00E-01	3.60E-04	2.54E-04	1.20E-04	1.91E-02
Kr-85	6.61E+10	3.00E-01	3.60E-04	N.A.	3.34E-10 (2)	2.38E-03
I-129	3.92E+05	3.00E-01	3.60E-04	2.54E-04	1.80E-01	1.94E-03
Cs-134	1.43E+11	5.00E-10	3.60E-04	2.54E-04	4.40E-02	2.88E-07
Cs-137	1.07E+12	5.00E-10	3.60E-04	2.54E-04	3.00E-02	1.47E-06
Sr-90	7.38E+11	5.00E-10	3.60E-04	2.54E-04	1.30E+00	4.39E-05
Ru-106	2.09E+10	5.00E-10	3.60E-04	2.54E-04	4.70E-01	4.49E-07
					Total Dose	0.023

Thyroid Dose

Nuclide	DSC inventory (uCi)	Release fraction	X/Q (sec/m^3)	Breathing rate (m^3/sec)	Tot. body inhalation DCF[10] (rem/uCi)	Dose at boundary (rem)
H-3	5.79E+09	3.00E-01	3.60E-04	2.54E-04	1.20E-04	1.91E-02
Kr-85	6.61E+10	3.00E-01	3.60E-04	N.A.	3.34E-10 (2)	2.38E-03
I-129	3.92E+05	3.00E-01	3.60E-04	2.54E-04	8.30E+00	8.93E-02
Cs-134	1.43E+11	5.00E-10	3.60E-04	2.54E-04	7.70E-02	5.03E-07
Cs-137	1.07E+12	5.00E-10	3.60E-04	2.54E-04	3.30E-02	1.61E-06
Sr-90	7.38E+11	5.00E-10	3.60E-04	2.54E-04	9.50E-03	3.21E-07
Ru-106	2.09E+10	5.00E-10	3.60E-04	2.54E-04	6.10E-02	5.83E-08
					Thyroid Dose	0.111

(1) Nearest residence is approximately. 4705 feet.
(2) Whole-body submersion DCF in rem-ms/uCi-sec (Reference 14).

After the radioactive material escapes the DSC, two factors are important in determining whether the particles reach the population: the fraction that becomes suspended in air, and the fraction that is respirable (less than 10 microns in diameter). A direction-independent atmospheric dispersion (X/Q) value was used to calculate a dose at the nearest controlled area boundary (0.74 mi. or 1.2 km), and the nearest residence (0.9 mi. or 1.4 km). The X/Q used is taken from Regulatory Guide 1.4,[12] and assumes Class F stability, 1 m/sec wind speed, and ground-level release.

The upper bound dose at the controlled area boundary due to the postulated accident which releases 30 percent of the tritium, noble gas, and iodine would be about 31 mrem to the whole-body and 148 mrem to the thyroid. The dose at the location of the nearest residence would be about 23 mrem to the whole-body and about 111 mrem to the thyroid. The resultant whole-body dose to an individual at the controlled area boundary is a small fraction of the 5 rem criteria specified in 10 CFR 72.106(b). These doses are also much less than the Protective Action Guides (PAGs) established by the Environmental Protection Agency (EPA) for individuals exposed to radiation as a result of accidents: 1 rem to the whole-body and 5 rem to the most severely affected organ. Thus, the release of effluents from the ISFSI due to accidents, even those with a very low probability of occurrence, will have a negligible impact on the population in the surroundings of the Calvert Cliffs Nuclear Power Plant.

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

6.2.3 Nonradiological Impacts

6.2.3.1 Land Use and Terrestrial Resources

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

6.2.3.2 Water Use and Aquatic Resources

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

The only water required for operation of the ISFSI, for decontamination of the transfer cask, will be used within the confines of the Calvert Cliffs Station Auxiliary Building and fall within the scope of impacts previously assessed for reactor operations.[2]

6.2.3.3 Other Impacts of Operation

Climatology

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

Noise

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

7.0 SAFEGUARDS FOR SPENT FUEL

The Commission's requirements for the protection of an ISFSI are set forth in 10 CFR Part 72, Subparts H and K, which include provisions for security plans, a security organization, response guards, detection aids, response force action, communication capability, and law enforcement agency liaison.

The applicant has submitted to the NRC a security, contingency and guard training and qualification plan which will commit to protecting the spent fuel against the design basis threat of radiological sabotage. These plans include the following:

- Barriers to limit unauthorized access to this storage installation,
- Access controls for personnel, vehicles, and packages,
- Search requirements to detect contraband materials,
- Detection and assessment capability for all alarms,
- Site specific training for security force members,
- Pre-planned contingency events and security actions,
- Commitments for responding to unresolved alarms,
- Provisions for obtaining support from the local law enforcement agency, and
- Secure transportation of the spent fuel from the reactor site to the ISFSI.

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

An independent safety review of the horizontal storage module design is being conducted by the NRC. Conservative data are used for safety analysis of the design, including design basis criteria, margins of safety, siting factors, quality assurance and physical protection. The potential for radiological sabotage, theft or diversion of spent fuel from the ISFSI with the intent of utilizing the contained special nuclear material (SNM) for nuclear explosives is not considered credible due to (1) the inherent protection afforded by the massive reinforced concrete storage module and the steel storage canister, (2) the unattractive form of the contained SNM, which is not readily separable from the radioactive fission products, and (3) the immediate hazard posed by the high radiation levels of the fuel to persons not provided radiation protection.

Accordingly, the storage of spent fuel at this ISFSI will not constitute an unreasonable risk to the public health and safety from acts of radiological sabotage theft, or diversion of SNM.

8.0 DECOMMISSIONING

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

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

Based on a separate NRC staff assessment,[13] annual occupational doses associated with unloading spent fuel from an ISFSI, after 20 years storage, for subsequent offsite shipment to a Federal MRS or repository are estimated to be small. If the DSC must be returned to the reactor buildings, and the fuel removed from the DSC, returned to the spent fuel storage pool, and loaded into a shipping cask, the occupational doses associated with storage cask and fuel handling are expected to be less than one-half of the values shown in Table 6.1. If the DSC is compatible with a certified shipping cask and easily inserted directly into the shipping cask from the HSM, doses to workers are expected to be about one-tenth of the doses shown in Table 6.1.

In accordance with the requirements of 10 CFR 72.30, a decommissioning plan has been submitted by the Applicant.[14] This document includes a commitment to establish an externally administered, sinking fund as described in 10 CFR 72.30(c)(5), to fund decommissioning costs. According to the requirements of 10 CFR 72.54, the licensee may apply to the NRC for authority to surrender a license voluntarily and to decommission the ISFSI within two years following permanent cessation of operations, and in no case later than one year prior to expiration of the license. The Applicant must receive approval of the final decommissioning plan from the NRC prior to the commencement of any decommissioning activities. The NRC will then terminate the license after determining that (1) the decommissioning has been performed in accordance with the approved final decommissioning plan and the order authorizing the decommissioning; and (2) the terminal radiation survey and associated documentation demonstrates that the ISFSI and site are suitable for release for unrestricted use.

9.0 SUMMARY AND CONCLUSIONS

9.1 SUMMARY OF ENVIRONMENTAL IMPACTS

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

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

The dose to the nearest resident from ISFSI operation is less than 1 mrem/yr, and when added to that of the operations of the two-unit Calvert Cliffs Nuclear Power Plant, is much less than 25 mrem/yr as required by 10 CFR 72.104. The collective dose to residents within 1 to 2 miles of the ISFSI is estimated to be less than .1 person-rem/yr. Occupational dose to site workers during HSM construction (24 person-rem/yr), and during ISFSI operation (24 person-rem/yr), is a small fraction of the total occupational dose commitment at the Calvert Cliffs Nuclear Power Plant (i.e., 350 person-rem/yr is the annual average occupational dose over 3 years ending in 1989). Individual doses are controlled to be within the limits established by 10 CFR Part 20.

The upperbound offsite radiological impacts due to accidents at the Calvert Cliffs ISFSI are about 31 mrem to the whole-body and 148 mrem to the thyroid of an individual located at the controlled area boundary, and about 23 mrem whole body and 111 mrem thyroid doses to the nearest resident. These doses are only a small fraction of the criteria specified in 10 CFR 72.106(b) and by the EPA Protective Action Guides. The Emergency Planning Zone (EPZ) for the ISFSI will coincide with that of the Calvert Cliffs Nuclear Power Plant (i.e., a 10-mile Plume Exposure Pathway and 50-mile Ingestion Pathway).

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

9.2 BASIS FOR FINDING OF NO SIGNIFICANT IMPACT

We have reviewed the proposed action relative to the requirements set forth in 10 CFR Part 51, and based on this assessment have determined that issuance of a materials license under 10 CFR Part 72 authorizing storage of spent fuel at the Calvert Cliffs 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

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3. Baltimore Gas and Electric Company, "Calvert Cliffs Independent Spent Fuel Storage Installation Environmental Report," December 1989.

4. Baltimore Gas and Electric Company, Letter from R. E. Denton to the NRC, "Response to NRC's Comments on Environmental Issues Regarding BG&E's License Application for Calvert Cliffs Independent Spent Fuel Storage Installation (ISFSI)," November 1, 1990.

5. Baltimore Gas and Electric Company, "Calvert Cliffs Nuclear Power Plant Final Safety Analysis Report."

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11.0 LIST OF AGENCIES AND PREPARERS

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