U.S. NUCLEAR REGULATORY COMMISSION

OFFICE OF FEDERAL AND STATE MATERIALS AND ENVIRONMENTAL MANAGEMENT PROGRAMS

DIVISION OF WASTE MANAGEMENT AND ENVIRONMENTAL PROTECTION

ENVIRONMENTAL ASSESSMENT FOR THE PROPOSED RENEWAL OF U.S. NUCLEAR REGULATORY COMMISSION LICENSE NO. SNM–2505 FOR CALVERT CLIFFS NUCLEAR POWER PLANT, LLC'S INDEPENDENT SPENT FUEL STORAGE INSTALLATION

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1.0 INTRODUCTION

1.1 Background

By letter dated September 17, 2010, Calvert Cliffs Nuclear Power Plant, LLC (CCNPP) submitted an application to the U.S. Nuclear Regulatory Commission (NRC) to renew NRC License SNM-2505 for the CCNPP site-specific Independent Spent Fuel Storage Installation (ISFSI) which expires on November 30, 2012 (CCNPP, 2010c). CCNPP supplemented its application on February 10, 2011 (CCNPP, 2011a). CCNPP is requesting that NRC License SNM-2505 be renewed for a period of 40 years. On March 11, 2011, the NRC staff found CCNPP's application to be acceptable for a detailed review (NRC, 2011a). In response to NRC staff requests for additional information, CCNPP provided supplemental information on June 14, June 28, and December 15, 2011 (CCNPP, 2011d; 2011e; 2011g).

NRC's regulations at 10 CFR 72.42 authorize the renewal of ISFSI specific licenses for a period not to exceed 40 years. The NRC issued this provision allowing for renewals of up to 40 years in a final rule published in the *Federal Register* on February 16, 2011 (76 FR 8872).

The NRC staff prepared this environmental assessment (EA) in accordance with the NRC regulations listed in 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions" and the NRC staff guidance document, NUREG-1748, "Environmental Review Guidance for Licensing Actions Associated with Nuclear Material Safety and Safeguards Programs" (NRC, 2003). 10 CFR Part 51 implements Section 102(2) of the National Environmental Policy Act of 1969, as amended.

The NRC staff also is performing a detailed safety analysis of the CCNPP proposal to assess compliance with 10 CFR Part 20, "Standards for Protection against Radiation," and 10 CFR Part 72, "Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste." The NRC staff's analysis will be documented in a separate safety evaluation report (SER). The NRC staff's decision whether to renew the CCNPP ISFSI license as proposed will be based on the results of the NRC staff's review as documented in this EA and in the SER.

1.2 Need for the Proposed Action

There are two nuclear generating units on the CCNPP site. Calvert Cliffs Units 1 and 2 began commercial operation in 1975 and in 1977, respectively, and the current facility operating licenses for Units 1 and 2 will expire on July 31, 2034 and August 13, 2036, respectively (NRC, 1999). CCNPP is requesting renewal of the ISFSI operating license to provide the option of continued temporary dry storage of spent nuclear fuel assemblies generated by operation of Units 1 and 2. This dry storage option would be needed until a facility (or facilities) is available for the offsite disposition of the spent fuel assemblies.

1.3 The Proposed Action

CCNPP has submitted a license renewal application requesting a renewal period of 40 years. If approved by the NRC, the expiration date for License SNM-2505 would be extended to November 30, 2052. Under its current license, CCNPP is authorized to receive, acquire and possess the power reactor spent fuel and other radioactive materials associated with spent fuel storage at the ISFSI in accordance with the requirements of 10 CFR Part 72.

1.3.1 Site Location and Description

The CCNPP site is located near the town of Lusby, in Calvert County, Maryland, approximately 96 kilometers (km) [60 miles (mi)] south of Baltimore, Maryland and 64 km (40 mi) southeast of Washington, D.C. (Figure 1). Flag Ponds Nature Park borders on the north, the Chesapeake Bay borders on the east, Calvert Cliffs State Park and Maryland State Route 765 are to the south of the site, and the Patuxent River and Maryland State Route 2/4 are to the west, (Figure 2). The ISFSI, occupying approximately 2 hectares (ha) [6 acres (ac)], is located outside the protected area for Units 1 and 2 (i.e., the area encompassed by a physical barrier and to which access is controlled) but within the controlled area (i.e., the area outside the protected area but within the site boundary), approximately 700 meters (2300 feet) southwest of the two nuclear power plants (CCNPP, 2010c).

The ISFSI is surrounded by open area for operational and security purposes (CCNPP, 2011f). This area is sloped to direct rainfall to collection ditches that channel the water away from the site (CCNPP, 2010c). Flood waters from locally intense rainfalls would need to rise at least 45.7 cm (18 inches) above yard grade to block the air inlets for the horizontal storage modules. CCNPP stated that there is adequate drainage at the ISFSI site to ensure that water does not accumulate to such depths (CCNPP, 2010c).

Around the site, the land consists of rolling hills that are partially forested with primarily deciduous trees (i.e., trees that lose all of their leaves for part of the year). The site topography includes relatively flat lands in developed areas and steeply sloped forested valleys. The site also has marshes, forested wetlands, streams, ponds, and tidal waters. The site borders on the Chesapeake Bay, and the land adjacent to the bay consists of cliffs approximately 21 m (70 ft) high, stone retaining walls, the natural shoreline, and sandy beaches.

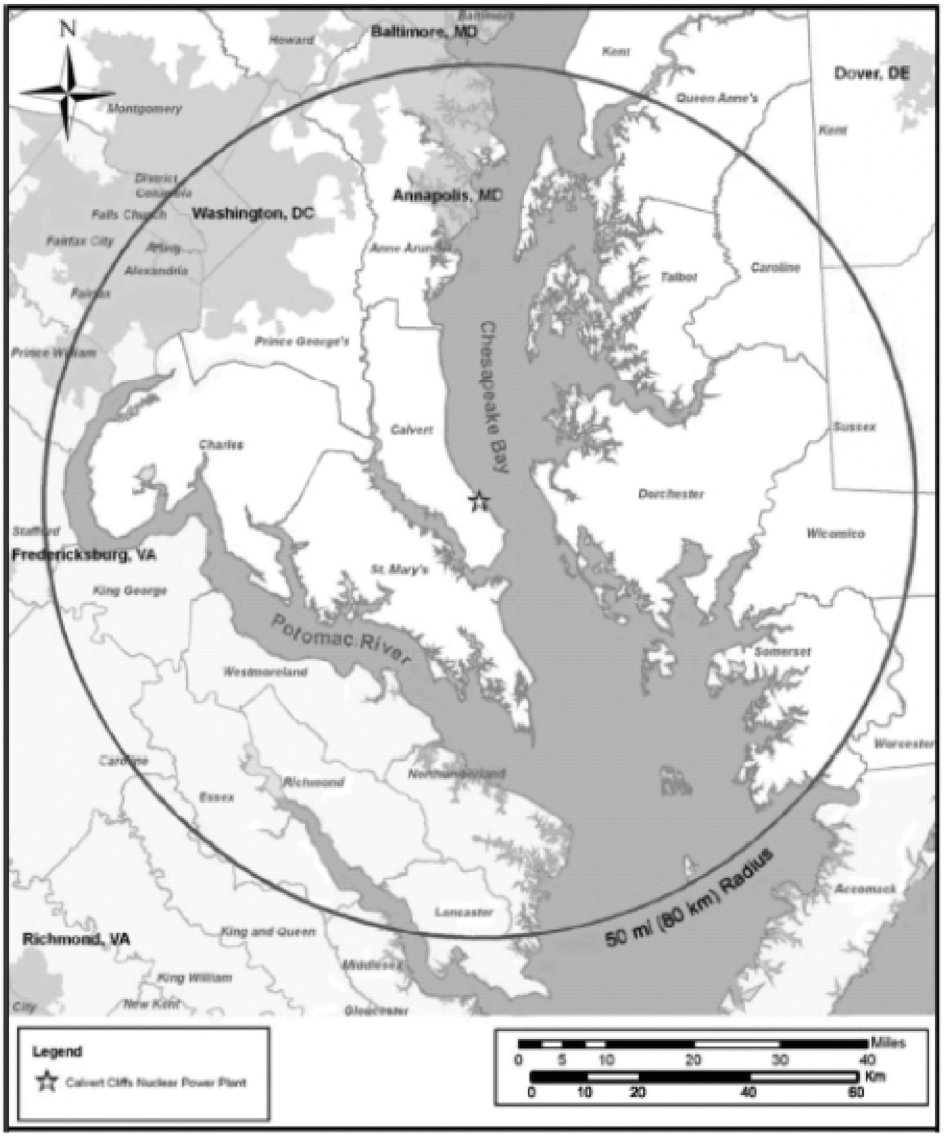

Figure 1: The Calvert Cliffs Site and 50-Mile Region (NRC, 2011k)

Figure 2: Calvert Cliffs Site Layout (NRC, 2011k)

1.3.2 Current ISFSI and Dry Cask Storage System Description

The current NRC license for the CCNPP ISFSI authorizes the construction and operation of 120 Horizontal Storage Modules (HSMs), which CCNPP is building incrementally to meet storage needs. To date, 72 HSMs have been constructed. The principal components of the system include an HSM, made of concrete and structural steel, and a steel dry shielded canister (DSC) with an internal basket that holds the spent fuel. Figure 3 shows the general design features of an HSM.

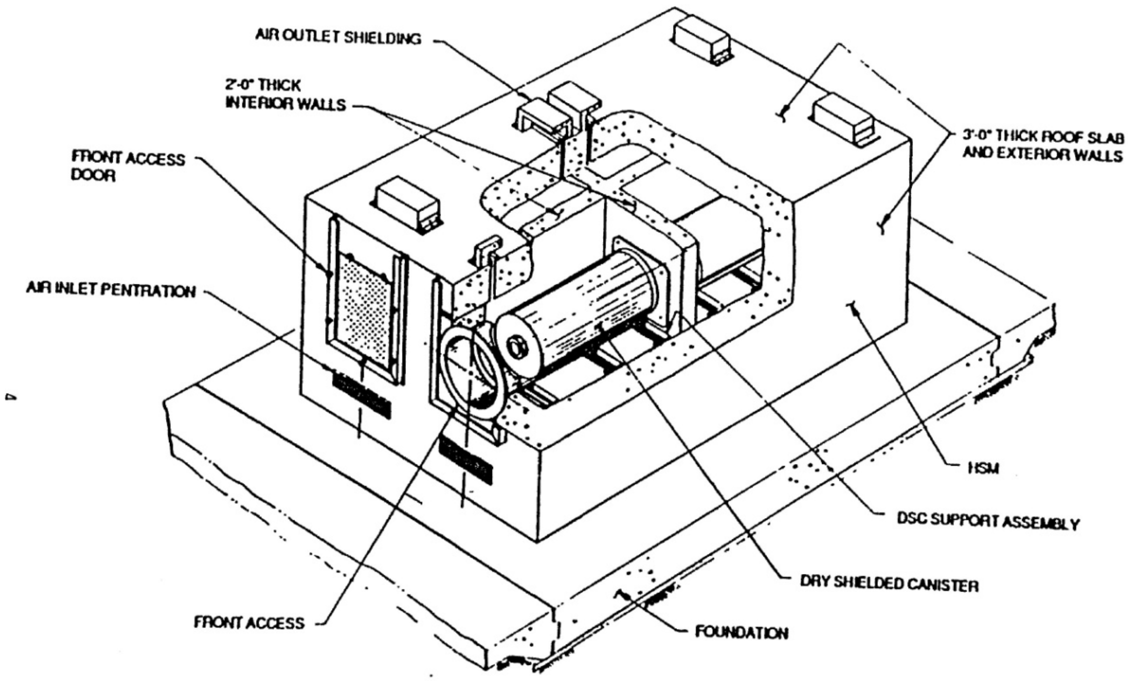

Figure 3: General HSM Design (NRC, 1991)

Each HSM is approximately 5.8 m (19 ft) long, 4.6 m (15 ft) high, and 2.6 m (8.7 ft) wide (NRC, 1991). The exterior walls and roof of an HSM are three feet thick, and the interior walls are two feet thick. Each HSM contains one DSC. The HSM provides structural support for the DSC, protects the DSC from extreme natural hazards, and provides radiation shielding. The concrete walls form interconnected sub-units of modules that are six feet wide. The ISFSI has sections composed of two rows, each of which contains six HSMs. The HSM dissipates heat from the spent fuel by a combination of radiation, conduction, and convection. Natural convection air flow enters at the bottom of the HSM, circulates around the DSC, and exits through the flow channels in the HSM roof slab. The thick concrete walls and roof of the HSM provide neutron and gamma shielding.

Each DSC serves as the confinement vessel during transfer of the irradiated fuel assemblies to and from an HSM, as well as during storage of the fuel assemblies in an HSM. The basic design of a DSC includes: (1) the basket with grid sleeves and supporting spacer disks for the fuel assemblies; (2) top and bottom shield plugs with lead gamma shielding to protect operating personnel during the DSC drying and sealing operations; (3) top and bottom stainless steel cover plates to ensure long-term confinement of the irradiated fuel; (4) siphon and vent ports; and (5) a stainless steel ram grapple ring to allow retrieval of the DSC. To ensure that the integrity of the DSC is not compromised under any kind of accident, the shield plugs and cover plates are independently seal welded. To protect against fuel or cladding oxidation during storage, helium gas is added to each DSC prior to storage.

The ISFSI initially was licensed to use the Nutech Horizontal Modular Storage (NUHOMS®)-24P dry storage system (NRC, 1991). The NUHOMS-24P internal basket assembly is comprised of 24 guide sleeves supported by spacer disks at intervals corresponding, for the most part, to the fuel assembly spacer grids. A single NUHOMS-24P DSC is sized to hold 24

pressurized water reactor (PWR) fuel assemblies. In 2005, the NRC granted CCNPP a license amendment (NRC, 2005a and 2005b) that authorized the use of Transnuclear NUHOMS-32P DSCs. The NUHOMS-32P DSC system stores eight more PWR spent fuel assemblies than the NUHOMS-24P DSC design, while using the same external and internal DSC shell dimensions. The NUHOMS-32P design does this by reducing the space between each fuel assembly and the size of the storage locations.

The ISFSI currently consists of 48 HSMs for the NUHOMS-24P DSC and 24 HSMs for the NUHOMS-32P DSC. All of the 48 NUHOMS-24P HSMs are loaded, and 21 of the NUHOMS-32P HSMs have been loaded. At present, 1824 spent fuel assemblies [(48 NUHOMS-24P HSMs x 24 assemblies per HSM) + (21 NUHOMS-32P HSMs x 32 assemblies per HSM)] are stored in the ISFSI. If the remaining 48 HSMs are constructed to use the NUHOMS-32P design, the ISFSI would accommodate 3456 fuel assemblies at full capacity.

In addition to the primary components (i.e., the HSM and the DSC), the ISFSI uses transfer equipment to move the DSCs from the spent fuel pool (where they are loaded with spent fuel) to the HSMs (where they are stored). The transfer equipment consists of a transfer cask, a hydraulic ram, a truck, a trailer, and a cask skid.

No electrical systems are needed for the HSM or DSC during storage other than for lighting and security system power. Electrical power is used during closure of the DSC at the spent fuel pool and during transfer of the DSC to the HSM at the ISFSI.

1.3.3 Waste Generation and Management

Loading of the DSCs and decontamination of the transfer casks generate radioactive waste. Contaminated pool water from loading a DSC drains back into the spent fuel pool. Air and helium purged from the DSC during loading are directed to the Auxiliary Building ventilation system. A small amount of liquid waste (less than 0.4 cubic meters [15 cubic feet] per DSC) results from decontamination of the transfer cask. This waste is sent to the CCNPP liquid waste processing system. A small amount (less than two cubic feet per DSC) of solid waste (e.g., disposable Anti-C garments, tape, decon cloths) is also generated from decontamination of the transfer cask. This waste is sent to the CCNPP solid waste processing system.

The ISFSI has no moving parts and therefore, no gaseous, liquid, solid, or radioactive waste is generated during normal storage operations.

1.3.4 Monitoring Programs

CCNPP performs routine monitoring activities. These activities include the Radiological Environmental Monitoring Program (REMP) for Units 1 and 2 and the ISFSI, daily monitoring of the ISFSI inlet and outlet vents, and monitoring and maintenance of the perimeter and security fences (CCNPP, 2011b).

The ISFSI REMP program objectives include:

- Verification that the radioactivity and ambient radiation levels attributable to ISFSI operation are within the limits in 40 CFR Part 190;

- Detection of any measurable buildup of long-lived radionuclides in the environment due to ISFSI operation;

- Monitoring and evaluation of ambient radiation levels around the ISFSI; and

- Determination whether there is a statistically significant increase in radionuclide concentrations near the ISFSI.

As part of the REMP, CCNPP collects air, vegetation, and soil samples and also measures direct radiation at specific locations surrounding the ISFSI. Table 1 summarizes the ISFSI environmental monitoring program. Figure 4 shows the locations where air samples (A1, SFA1-SFA4), vegetation samples (SFB1-SFB5), and soil samples (SFS1-SFS5) are taken, and also the location where direct radiation from the ISFSI is monitored (DR07, DR30, SFDR01-SFDR18). All sampling locations and monitoring stations are located within 1km of the ISFSI.

Table 1: ISFSI Environmental Monitoring Program

Media	Number of Sample Locations	Sampling Frequency	Monitoring For
Air	5	Weekly	Beta activity; gamma emitting radionuclides
Soil	5	Quarterly	Gamma emitting radionuclides
Vegetation	5	Quarterly	Gamma emitting radionuclides
Direct Radiation	19	Quarterly	External radiation levels
CCNPP, 2011b			

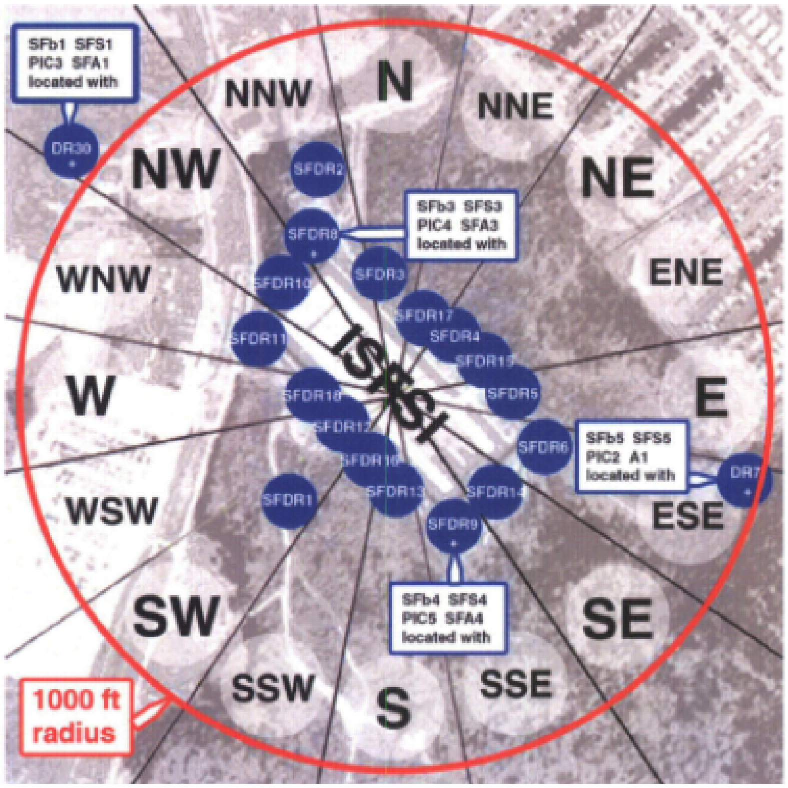

Figure 4: ISFSI Sampling Locations (CCNPP, 2011b)

Table 2 summarizes the results from the ISFSI environmental monitoring program over the last 10 years. Neither Iodine-131 nor gamma-emitting radionuclides were detected on the air particulate filters (data not shown). Although beta-emitting radionuclides were detected on the air particulate filters, the measured concentrations were similar to concentrations measured for the control samples.

Table 2: ISFSI Environmental Monitoring Program Results for 1999-2010.*
(Data in parentheses are those from control samples and indicate background concentrations)

Year	Beta-emitters in Air+ (10^{-2} pCi/m^3)	Cesium-137 in Vegetation+ (pCi/kg wet)	Cesium-137 in Soil+ (pCi/kg dry)	Direct Radiation (mR/90 days)
1999	1.7 ± 0.02 (1.7 ± 0.03)	NP**	326 ± 14 (135 ± 23)	18.82 ± 0.31 (13.45 ± 0.47)
2000	1.6 ± 0.01 (1.6 ± 0.03)	NP	206 ± 10 (104 ± 20)	17.74 ± 0.29 (11.61 ± 0.69)
2001	1.7 ± 0.01 (1.6 ± 0.03)	1 ± 1	167 ± 7 (128 ± 20)	21.47 ± 0.38 (12.43 ± 0.36)
2002	1.7 ± 0.01 (1.9 ± 0.03)	3 ± 1	224 ± 10 (144 ± 19)	22.56 ± 0.39 (13.45 ± 0.44)
2003	1.4 ± 0.01 (1.5 ± 0.03)	10 ± 3	150 ± 8 (82 ± 16)	23.68 ± 0.52 (13.77 ± 0.61)

Year	Beta-emitters in Air+ (10^{-2} pCi/m^3)	Cesium-137 in Vegetation+ (pCi/kg wet)	Cesium-137 in Soil+ (pCi/kg dry)	Direct Radiation (mR/90 days)
2004	1.5 ± 0.01 (1.6 ± 0.03)	NP	123 ± 8 (36 ± 11)	25.75 ± 0.50 (13.50 ± 0.62)
2005	1.7 ± 0.01 (1.5 ± 0.03)	NP	201 ± 15 (90 ± 28)	25.33 ± 0.63 (12.04 ± 0.36)
2006	1.9 ± 0.02 (1.7 ± 0.03)	NP	216 ± 17 (79 ± 24)	27.92 ± 0.52 (12.64 ± 0.57)
2007	1.9 ± 0.01 (1.9 ± 0.03)	7 ± 3	294 ± 17 (100 ± 20)	27.11 ± 0.49 (13.00 ± 0.61)
2008	1.8 ± 0.02 (1.9 ± 0.03)	10 ± 2	124 ± 10 (44 ± 15)	24.75 ± 0.50 (12.34 ± 0.55)
2009	2.2 ± 0.02 (2.3 ± 0.04)	NP	108 ± 10 (103 ± 21)	26.48 ± 0.61 (13.16 ± 0.56)
2010	2.2 ± 0.02 (2.0 ± 0.02)	4 ± 1	117 ± 9 (63 ± 17)	26.27 ± 0.63 (12.84 ± 0.56)
* Data drawn from CCNPP site calendar year REMP reports (CCNPP, 2000b; 2001b; 2002b; 2003b; 2004b; 2005b; 2006b; 2007b; 2008b; 2009b; 2010b; 2011c) + average concentrations ** NP = Not provided				

For calendar year 2010, low levels of cesium-137 were measured in soil samples gathered at sampling locations surrounding the ISFSI. CCNPP found that the concentration levels were consistent with levels measured in prior years and with levels measured during pre-operational monitoring (CCNPP, 2011c). CCNPP therefore attributed the measured Cs-137 concentrations to fallout from atmospheric weapons testing. Naturally-occurring radionuclides (e.g., beryllium-7 in air samples; potassium-40 in vegetation samples) also were observed in the vicinity of the ISFSI (CCNPP, 2011c).

As discussed in the previous section, ISFSI operation generates no gaseous, liquid, or solid wastes, and so CCNPP performs no other physical, chemical, or ecological monitoring related to ISFSI operation. Additionally, since the ISFSI has no moving parts, maintenance only includes daily inspection of the HSM air inlets and outlets and removal of any debris that may be present.

CCNPP normally inspects HSM inlet and outlet vents remotely by camera, with inspection results recorded daily (CCNPP, 2011d). If remote visibility is impaired, CCNPP security personnel conduct the daily inspections from the periphery of the ISFSI. Since 1993, actual or potential blockage of the inlet and outlet vents has occurred only four times, with two events caused by snow and the other two by growing weeds. In response, CCNPP personnel cleared the snow or the weeds (CCNPP, 2011d).

1.3.5 Decommissioning

When the license for the CCNPP ISFSI is terminated, CCNPP will decontaminate and decommission the ISFSI structure with the decommissioning technology available at the time of decommissioning. The actual detailed decommission plan will be designed consistent with the applicable regulation at the time of decommissioning and submitted for NRC review and approval. Criteria addressing the decommissioning of site-specific ISFSIs and the submittal of a final decommissioning plan for an ISFSI are provided under 10 CFR 72.54(d) and (g).

CCNPP stated that decommissioning of the ISFSI may be performed in conjunction with decommissioning of the CCNPP site. However, CCNPP expects that the costs of decommissioning the ISFSI will represent a small fraction of the total costs of decommissioning the CCNPP site.

CCNPP stated that the activities expected in decommissioning the CCNPP ISFSI are the removal of the spent fuel from the site for transfer to an offsite federal repository, and the decontamination and dismantling of the concrete HSMs. Assuming the DSC is compatible with a shipping cask certified by the NRC and the U.S. Department of Transportation and that the DSC is easily inserted directly into the shipping cask from the HSM, NRC staff expects that doses to workers would be about 0.15 person-rem per DSC (NRC, 1991).

1.4 Basis for Review

In preparing this EA, the NRC staff reviewed and considered the following documents:

- CCNPP's site-specific ISFSI license renewal application (with a supplemental environmental report included as Appendix E to the application) (CCNPP, 2010c).
- CCNPP's "Responses to Request for Additional Information, RE: Calvert Cliffs Independent Spent Fuel Storage Installation License Renewal Application" (CCNPP, 2011d).
- CCNPP's site-specific ISFSI Updated Final Safety Analysis Report (CCNPP, 2011f).
- Environmental Assessment Related to Construction and Operation of the Calvert Cliffs Independent Spent Fuel Storage Installation (NRC, 1991).
- Environmental Impact Statement for the Combined License (COL) for Calvert Cliffs Nuclear Power Plant Unit 3 (NRC, 2011k).

Additional references may be found in Section 8.0 of this EA.

2.0 ALTERNATIVES TO THE PROPOSED ACTION

In this chapter, the NRC staff describes alternatives to the proposed 40 year license renewal and decides which alternatives will be evaluated in detail in Chapter 4.

2.1 Alternatives Considered in Detail

2.1.1 No-Action

The no-action alternative would result in denial of CCNPP's request to renew the ISFSI license. The ISFSI license would expire on November 30, 2012. CCNPP would remove the stored fuel from the ISFSI, transport the fuel to another storage facility, and decommission the ISFSI. This no-action alternative provides a basis for comparison of potential environmental impacts with those from the proposed action and other reasonable alternatives. The NRC staff considers the impacts of the no-action alternative alongside those of the proposed action in Chapter 4.

2.1.2 License Renewal for an Additional 20-year Term

The CCNPP ISFSI was originally licensed for a 20-year period of operations. Under this alternative, the ISFSI license would be renewed for an additional 20-year period, with an expiration date of November 30, 2032. This date would be two years prior to the expiration date for Unit 1 and four years prior to the expiration date for Unit 2. Given the delay in the licensing of a federal repository for spent nuclear fuel, fuel stored in the ISFSI may not be moved offsite to such a repository prior to the expiration dates of Unit 1 or Unit 2. As a result, CCNPP would then need to have the ISFSI license renewed again so as to provide for continued temporary dry storage of spent fuel from those two power plants.

For the 20-year alternative, only the potential impacts to public and occupational health and for waste management are discussed in the EA. The NRC staff did not separately address the 20-year alternative for the other resource areas, because the staff determined that, for those resource areas, the site operations and the types of potential environmental impacts associated with those operations would be the same for the 20-year alternative as for the proposed action, i.e., the 40-year license renewal.

2.2 Alternatives Eliminated from Detailed Consideration

2.2.1 Construct and Operate a New ISFSI at the CCNPP Site

CCNPP could submit an application to NRC for the construction and operation of an additional onsite ISFSI for the temporary dry storage of spent fuel from Units 1 and 2. Potential environmental impacts associated with this alternative would include those from the construction, operation, and decommissioning of the new ISFSI. These potential impacts would be similar to the impacts experienced during the construction of the existing ISFSI. In addition, the license for the existing ISFSI would be modified to end the loading of additional spent fuel, which would then be stored at the new ISFSI. Given the combined environmental impacts of constructing one ISFSI and of operating and decommissioning two ISFSIs, the NRC staff does not consider this to be a reasonable alternative that warrants detailed analysis in this EA.

2.2.2 Increase the Storage Capacity of the Onsite Existing Spent Fuel Pools or Construct Additional Onsite Spent Fuel Pool Storage Space

As an alternative to the proposed action, CCNPP could increase the storage capacity of the existing spent fuel pools or construct a new spent fuel storage pool. However, the spent fuel pools in Units 1 and 2 have been re-racked already, increasing the pool capacity to its maximum (NRC, 1991). Design limitations of the pools preclude further expansion, thus eliminating this alternative as a viable option for meeting increased storage needs (NRC, 1991). Therefore, the NRC staff concludes that capacity increases for the CCNPP spent fuel pools are not a reasonable alternative to renewing the CCNPP site-specific ISFSI license and this alternative is not considered in further detail.

A new storage pool would require new fuel handling equipment, large capacity cask crane, building ventilation, and a water quality system. Furthermore, CCNPP would have to transfer fuel assemblies from the existing ISFSI into the pool and subsequently decommission the ISFSI. These alternatives would result in higher occupational exposure for the additional maintenance and surveillance activities associated with operating the storage pool. As a result of increased dose exposure and the environmental impacts associated with new construction, the NRC staff concludes that this alternative is not reasonable and therefore is not considered in detail.

2.2.3 Shipment of Spent Fuel to an Offsite Facility

As an alternative to the proposed action, CCNPP could ship the spent fuel at the ISFSI to an offsite facility. Implementation of this alternative would minimize the environmental impacts associated with continued operation of the ISFSI. However, there would be radiological and non-radiological impacts resulting from activities such as packaging and transferring of the spent fuel to an offsite facility.

Alternatives, such as CCNPP's shipment of its spent fuel to a commercial reprocessing facility, a federal consolidated interim storage facility, or a federal repository for disposal, are not reasonable given that no such facilities are currently available in the United States.

CCNPP could ship its spent fuel to another nuclear power plant with sufficient storage capacity. In order for this option to be viable, the receiving plant would have to be licensed to accept the CCNPP spent fuel and would have to be willing to accept the fuel. Since the NRC staff expects that nuclear power plants would consider their own spent fuel storage capacity needs before accepting spent fuel from other sources, and most plants are expected to face their own storage challenges, the NRC staff concludes that this alternative is not reasonable. CCNPP could attempt to ship its spent fuel to another nuclear power plant in the Constellation Energy Nuclear Group, LLC (CENG) family. However, the NRC staff expects this option, as with sending the spent fuel to a non-CENG facility, would only aggravate the spent fuel storage capacity issues at the receiving facility. Therefore, this is also not a reasonable alternative that warrants detailed analysis.

3.0 AFFECTED ENVIRONMENT

The discussion of the affected environment provided in this section is summarized from NUREG-1936, "Environmental Impact Statement for the Construction License (COL) for Calvert Cliffs Nuclear Power Plant Unit 3" (NRC, 2011k). For a more detailed presentation on the local and regional environment in the vicinity of the CCNPP site, the reader is referred to NUREG-1936.

3.1 Land Use

According to its 2010 Comprehensive Plan (CCBCC, 2010), Calvert County covers approximately 56,656 ha (140,000 acres) of land. As shown in Table 3, almost half of the total land remains forested; most of the remaining land has been cleared for agriculture or developed for residential, commercial, or industrial purposes.

Table 3: Calvert County Land Use

Land Use	Approximate Area	Approximate Percentage of Total Area
Development	20,644 ha (51,013 acres)	37%
Agriculture	7,358 ha (18,181 acres)	13%
Forest	25,985 ha (64,211 acres)	47%
Other	1,588 ha (3,923 acres)	3%
Total Area	55,575 ha (137,328 acres)	100%
CCBCC, 2010		

As discussed in Section 1.2, the Calvert Cliffs site contains two existing nuclear generating units, CCNPP Units 1 and 2. Together, the two existing nuclear units and associated facilities occupy approximately 134 ha (331 acres) of the Calvert Cliffs site. Approximately 655 ha (1619 acres) of the site is forest area, and approximately 43 ha (106 acres) is open land that was previously used for agriculture (UniStar, 2009b) (Figure 5).

Recreational areas within 16 km (10 mi) of the Calvert Cliffs site include Flag Ponds Nature Park to the north of the site and Calvert Cliffs State Park to the south (Figure 6). Flag Ponds Park receives approximately 20,000 annual visitors, primarily during the three summer months (NRC, 2011k). Calvert Cliffs State Park, identified as one of the gateways to various activities in the bay (Chesapeake Bay Gateways Network, 2011), had 17,113 day and 2,175 overnight visitors from July 2005 to June 2006. The peak month for day users was October (5650 people), the peak month for overnight users was July (875 people), and the month with the most visitors (both day and night users) was October (6035 people) (NRC, 2011k).

Additionally, routes for two water-based historic trails pass by the site in the Chesapeake Bay. The Captain John Smith Chesapeake National Historic Trail, officially launched on May 12, 2007, is the first national water trail (Captain John Smith Chesapeake National Historic Trail,

2011). The Star-Spangled Banner National Historic Trail is currently in its planning stages (National Park Service, 2011). These two water-based trails are discussed in more detail in Section 3.9.

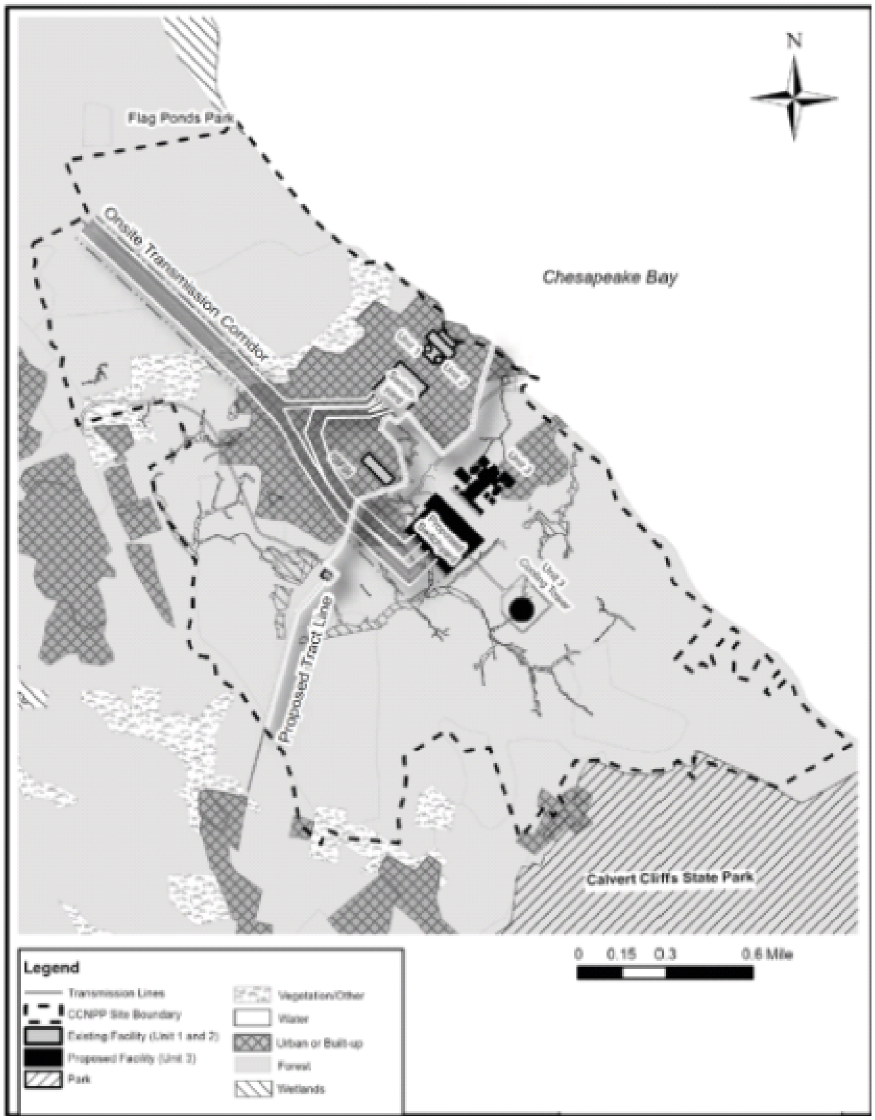

Figure 5: Land Use on the Calvert Cliffs Site (NRC, 2011k)

Other activities in the vicinity of the CCNPP site include (1) the Dominion Cove Point liquid natural gas import facility about 5.6 km (3.5 mi) southeast of the site, and (2) the Naval Air Station Patuxent River about 14 km (9 mi) south of the site (NRC, 2011k).

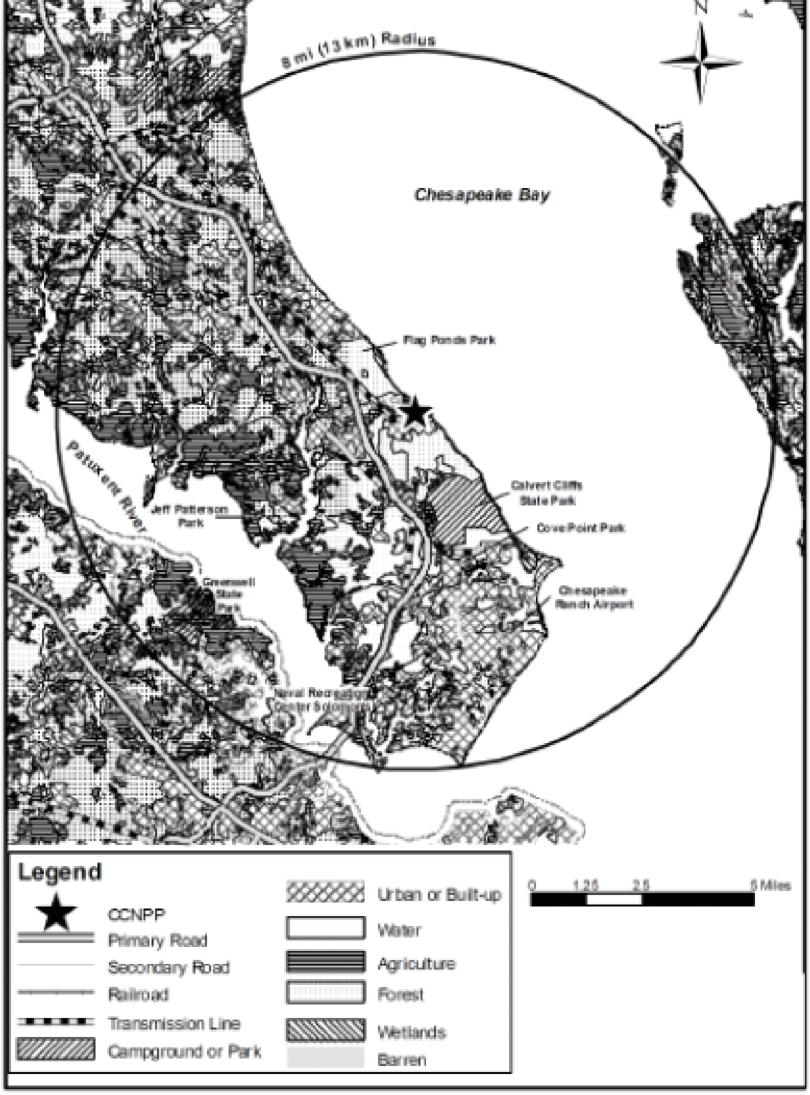

Figure 6: Land-Use Classification within 8 Miles of the Calvert Cliffs Site (NRC, 2011k)

3.2 Transportation

Maryland State Route (MD SR) 2/4 bisects Calvert County from north to south with smaller roads running from the main road to the water on each side. Because very few of these smaller roads connect with each other, MD SR 2/4 services the bulk of the traffic for the length of the county and provides the only access to the site (Figure 2). The annual average daily two-way traffic volume on MD SR 2/4 in the vicinity of the Calvert Cliffs site is 27,162 vehicles (Maryland Department of Transportation, 2011).

Commercial air traffic into and out of Calvert County comes from the Chesapeake Ranch Airpark [a private residential airpark located approximately 10 km (6 mi) from the CCNPP site] (Southern Maryland Online, 2011) and a helipad on the CCNPP site that is available for

corporate and Medivac flights (NRC, 2011k). In addition, there are three major commercial airports in the region: (1) Baltimore/Washington International Thurgood Marshall Airport [approximately 84 km (52 mi) from site]; (2) Reagan National Airport [approximately 69 km (43 mi) from the site]; and (3) Washington Dulles International Airport [approximately 101 km (63 mi) from the site].

3.3 Demography and Socioeconomic Factors

The area within a 16-km (10-mi) radius of the Calvert Cliffs site is predominantly rural and includes the cities and unincorporated towns of California, Calvert Beach-Long Beach, Chesapeake Ranch Estates-Drum Point, Lusby, and Prince Frederick. The land occupied by CCNPP is located in an unincorporated portion of Calvert County.

According to the 2010 Census (USCB, 2010), Calvert Count has a population of 88,737, which is an increase of 19.0% since 2000. As seen in Table 4, this growth rate is less than half that experienced for each of the previous three decades.

Table 4: Population Growth Data

Region	1970 (% Growth)	1980 (% Growth)	1990 (% Growth)	2000 (% Growth)	2010 (% Growth)
Calvert County	20,682[a]	34,638[a] (67.5%)	51,372[a] (48.3%)	74,563[a] (45.1%)	88,737[b] (19.0%)
Maryland	3,922,399[b] (26.5%)	4,216,975[b] (7.5%)	4,781,468[b] (13.4%)	5,296,486[b] (10.8%)	5,773,552[b] (9.0%)
[a]CCBCC, 2010; [b]USCB, 2010					

The Maryland Department of Planning projects a Calvert County population of 105,200 in Year 2040 (Maryland Department of Planning, 2010). If this population is reached, it would represent an 18.5% increase over the 2010 census population count.

The Southern Region of Maryland, which includes Calvert County, St. Mary's County, and Charles County, recorded 541,791 visitors in 2004 (UniStar, 2009b). Major parks within the 16-km (10-mi) vicinity include Calvert Cliffs State Park and Flag Ponds Park.

As of September 2009, 16,661 students were enrolled in 25 schools (includes 13 elementary, 6 middle, and 4 high schools) run by the Calvert County Public School system. The school system is also responsible for an adult education facility, a Career and Technology Academy, and the Arthur Storer Planetarium (BECC, 2010).

Based on 2010 Census data, the number of households in Calvert County was 30,873 as compared to 2,156,411 for the state of Maryland. The 2009 median household income for Calvert County was $86,281 as compared to $69,193 for the entire state of Maryland (USDA ERS, 2011). Furthermore, 5.4 % of residents in Calvert County lived below the poverty line in 2009 as compared to 9.2% for the state of Maryland (USDA ERS, 2011).

According to the Maryland Department of Labor, Licensing and Regulation (DLLR, 2011), the Calvert County unemployment rate was 5.7% in May 2011. In comparison, the Maryland unemployment rate for May 2011 was 6.9%. Major employers (i.e., those employing at least

250 individuals) in the county as of March 2010 include Calvert Cliffs Nuclear Power Plant, Calvert Memorial Hospital, Giant Food Stores, and Wal-Mart/Sam's Club (DLLR, 2010).

3.4 Climatology, Meteorology, and Air Quality

The Calvert Cliffs site is located in Calvert County in the southern portion of Maryland. Its climate is influenced by the Atlantic Ocean and the Chesapeake Bay to the east, and the Appalachian Mountains to the west. These features give the site a more moderate climate than is found at inland sites at the same latitude.

Temperature data from the Calvert Cliffs meteorological tower for the years 2000-2005 show monthly average temperatures range from about 1°C (34°F) in January to about 24°C (75°F) in July (NRC, 2011k). Climatological records for the period 2000- 2010 from Naval Air Station Patuxent River, located about 14 km (9 mi) from the site, show monthly average wind speeds ranging from 6 to 8 knots (3.1 to 4.1 meters per second / 6.9 to 9.2 miles per hour). The higher speeds are experienced during December to April and the lower speeds during July and August, and the mean wind direction is S-SW (Naval Air Station Patuxent River, 2011a; 2011b). Precipitation is uniformly distributed throughout the year. All months average less than 1.2 centimeters (0.5 inch) of precipitation, with the most precipitation occurring in December (Naval Air Station Patuxent River, 2011b).

Climatological records show that the area experiences occasional severe weather: thunderstorms, ice storms, hurricanes, and tornadoes. Thunderstorms occur on an average of about 28 days per year, with 90% of these days occurring between April and September. Heavy snow and ice typically occur several times per winter season. Hurricanes rarely strike the Maryland coastal region. However, about once a year, a hurricane or tropical storm will come within 161 km (100 mi) of the Maryland coast. On September 17, 2003, tropical storm Isabel caused 4 to 5 ft waves at Solomons and North Beach in Calvert County, Maryland and the Naval Air Station Patuxent River recorded wind gusts of up to 30.8 m/s (69 mph) (http://www4.ncdc.noaa.gov/cgi-win/wwcgi.dll?wwevent~ShowEvent~499561). In August 2011, hurricane Irene reached the Maryland coast as a category 1 hurricane (http://www.ncdc.noaa.gov/ sotc/tropical-cyclones/2011/8). Since 1950, there have been 14 tornadoes reported in Calvert County (http://www.tornadohistoryproject.com/ tornado/Maryland/Calvert).

The National Ambient Air Quality Standards (NAAQS) set by the U.S. Environmental Protection Agency (EPA) specify the acceptable air concentration thresholds for six common non-radiological pollutants: nitrogen oxides, ozone, sulfur oxides, carbon monoxide, lead, and particulate matter. Compliance is determined individually for each pollutant, and an area is classified as "in attainment" when concentration levels comply with NAAQS standards.

Calvert County is in the Southern Maryland Intrastate Air Quality Control Region (40 CFR 81.156). The county is in attainment with NAAQS with the exception of the eight-hour NAAQS for ozone. Non-attainment of this NAAQS is attributed to Calvert County's proximity to Washington, D.C (CCNPP, 2010c).

3.5 Geology and Seismology

3.5.1 Geology and Soils

The Calvert Cliffs site is located within the Coastal Plain physiographic province, approximately 64 km (40 mi) east of the fall line that separates the Coastal Plain and Piedmont physiographic provinces. Figure 7 shows the geology beneath the site. The immediate (surficial) sediments beneath the site consist of sand and gravel deposits. Beneath the surficial sediments is the Chesapeake confining unit, which consists of alternating silt and clay units with some thin and discontinuous sand layers.

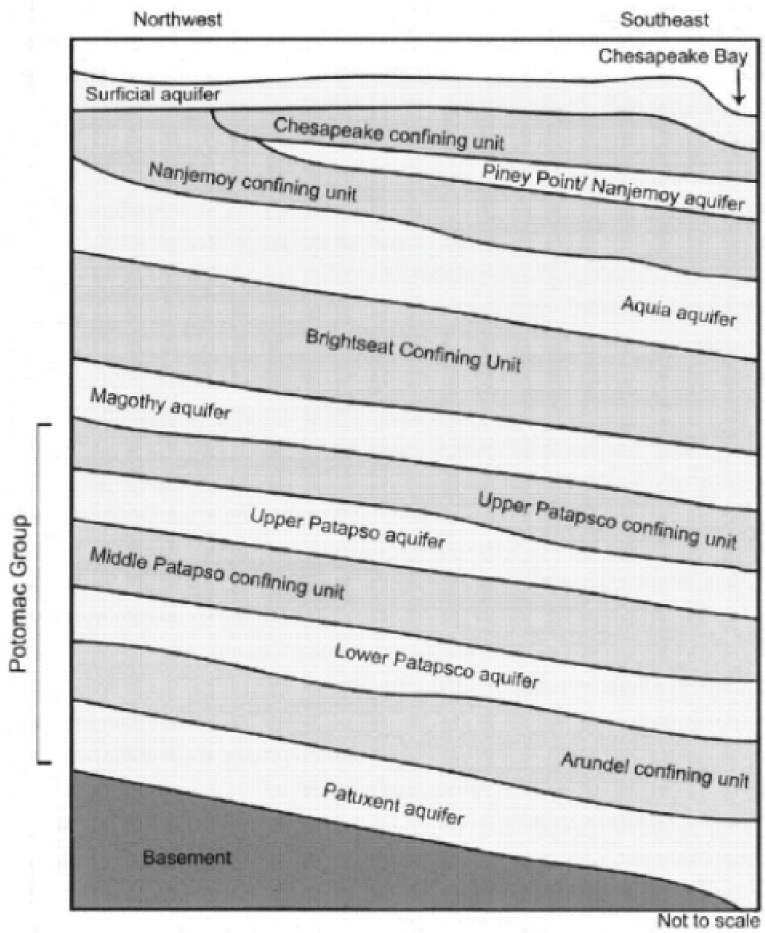

Figure 7: Major Soil Layers and Aquifers Beneath the Calvert Cliffs Site (UniStar, 2009b)

Below the Chesapeake confining unit are the 6-m-thick (20-ft-thick) Piney Point/Nanjemoy aquifer and the 55-m-thick (180-ft-thick) Nanjemoy confining unit. The sedimentary formations continue downward more than 610 m (2000 ft). However, these deeper formations are not affected by operation of the Calvert Cliffs ISFSI given that there are no liquid effluents from ISFSI operations.

3.5.2 Seismology

According to the Electric Power Research Institute (EPRI), the CCNPP site is in a seismic region "characterized by low rates of crustal deformation and no active plate boundary conditions" (EPRI, 1986). However, there are two potential seismic sources within 322 km (200 mi) of the CCNPP site: the Central Virginia Seismic Zone in Virginia and the Lancaster Seismic Zone in southeast Pennsylvania (UniStar, 2009a). These zones are shown in Figure 8.

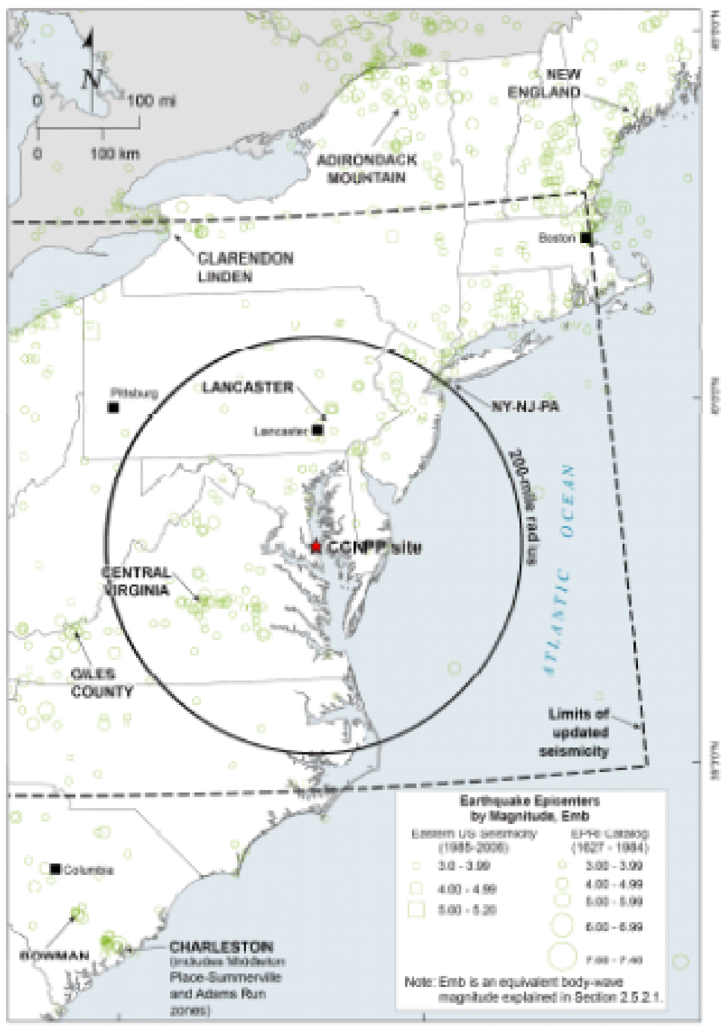

Figure 8: Seismic Zones and Seismicity in the Vicinity of the CCNPP Site (UniStar, 2009a)

The Central Virginia Seismic Zone (CVSZ) is located in the Piedmont physiographic province and generally is characterized by low-level seismicity. The zone extends about 121 km (75 mi) in a north-south direction and about 145 km (90 mi) in an east-west direction from Richmond to Lynchburg and is coincident with the James River (Bollinger and Sibol, 1985). The CCNPP site is located 76 to 100 km (47 to 62 mi) northeast of the northern boundary of the CVSZ (UniStar, 2009a). The largest recent earthquake within this seismic zone was a magnitude 5.8 quake that occurred near Mineral, Virginia, on August 23, 2011 (USGS, 2011). This event happened

approximately 142 km (88 mi) from the Calvert Cliffs site (Unistar, 2011), with intensities at the CCNPP site categorized as “weak” and ground acceleration lower than 0.05g (USGS, 2011).

The Lancaster Seismic Zone, which is the most active seismic zone in Pennsylvania, encompasses seismic activity in Lancaster, York, Lebanon, and Berks Counties in southeast Pennsylvania (Pennsylvania Department of Conservation and Natural Resources, 2003). It is about 129 km (80 mi) long and 129 km (80 mi) wide. The CCNPP site is located about 179 km (111 mi) southeast of the southern boundary of the Lancaster seismic zone (UniStar, 2009a). The largest recent earthquake within this seismic zone was a magnitude 4.6 quake in Berks County on January 15, 1994 (Pennsylvania Department of Conservation and Natural Resources, 2003).

3.6 Water Resources

3.6.1 Groundwater Hydrology

Figure 7 shows the major aquifers beneath the Calvert Cliffs site. The Surficial aquifer is the only aquifer relevant to the operation of the Calvert Cliffs ISFSI. The sediments of the Surficial aquifer are classified as medium-grained, silty, or clayey sands (NRC, 2001k), which means the sediments have a sandy appearance and grain size. The aquifer exists when the ground surface is above 20 m (65 ft) and the aquifer is up to 17 m (55 ft) thick. The aquifer, which is primarily used for irrigation, is recharged by precipitation. At the site, there are no groundwater wells in the Surficial aquifer.

3.6.2 Surface Water Hydrology

The primary surface-water bodies in the vicinity of the Calvert Cliffs site are the Chesapeake Bay to the east and the Patuxent River to the west. The Patuxent River flows southeast and empties into the Chesapeake Bay about 13 km (8 mi) south of the site. Although both the Bay and the Patuxent River experience tidal forces, water bodies on the site are not affected.

Over the last 100 years, sea-level rise in the Chesapeake Bay is estimated at 0.4 m (1.3 ft) and sea levels may rise by an additional 0.6-0.9 m (2-3 ft) in the next 100 years (Tidal Sediment Task Force, 2005). Sea-level rise and wave action have caused erosion and buildup (via deposition) of the shoreline near the Calvert Cliffs site. Estimates of shoreline changes range from -1.2 m (-4 ft) to +0.6 m (+2 ft) per year (NRC, 2011k).

Small streams drain surface water from the Calvert Cliffs site. The eastern side of the site has manmade Lake Conoy, two small ponds below it, and two streams (Branches 1 and 2) that drain into the Chesapeake Bay. The western side of the site drains through St. Leonard Creek to the Patuxent River. The manmade Lake Davies is on this side of the site. Several short-lived streams (including Branch 3, Branch 4, Laveel, and Goldstein) drain into Johns Creek, which flows offsite into St. Leonard Creek. Within and downstream of the Calvert Cliffs site, wetlands occupy areas along the streams (see Figure 5).

3.7 Ecology

The topography of the site consists of rolling hills that are partially forested with primarily deciduous trees. Surface elevations range from 0 m (0 ft) to 40 m (130 ft) above mean sea level. The ecological features in the area are characterized by emergent and forested wetlands, streams, ponds, and tidal waters. The Chesapeake Bay region provides a wide array of habitats for plants and animals.

3.7.1 Aquatic Resources

The Chesapeake Bay is the largest and most important aquatic resource in the vicinity of the Calvert Cliffs ISFSI. Other primary aquatic resources in the area include St. Leonard Creek and the Patuxent River. Although commercial fisheries are not allowed at any of Calvert Cliffs' freshwater resources, the American eel (*Anguilla rostrata*) is a commercially-fished species that can be found in some of the creeks on the Calvert Cliffs site and in the Chesapeake Bay near the site (NRC, 2011k).

3.7.2 Terrestrial Resources

According to surveys conducted by the Maryland Department of Natural Resources in 2006, eight major cover types were identified at the Calvert Cliffs site (NRC, 2011k). The cover types and their dominant vegetative and wildlife species are provided in Appendix A. The area of the site where the ISFSI is located is dominated by the landscaping and development cover type and surrounded by mixed deciduous and regenerated mixed deciduous forests cover types. Therefore, white-tailed deer, coyote, eastern cottontail rabbits, red foxes, yellow warblers, American crows, northern mockingbirds, wild turkeys, worm snakes, and American toads are expected to be observed in the vicinity of the ISFSI.

3.7.3 Threatened and Endangered Species

The federal and the state special-status species found in Calvert County, Maryland are identified in Appendix B.

In a letter addressed to the NRC, the Maryland Department of Natural Resources (MDNR) determined that there were no State or Federal records for rare, threatened, or endangered species in the vicinity of the ISFSI (MDNR, 2011). Additionally, CCNPP stated that critical habitat for such species is not found adjacent to the ISFSI (CCNPP, 2011d).

The NRC staff consulted with the National Oceanic and Atmospheric – National Marine Fisheries Service (NOAA NMFS) (NRC, 2011f). NOAA NMFS confirmed that the federally-endangered shortnose sturgeon and several species of listed sea turtles occur in the Chesapeake Bay adjacent to the Calvert Cliffs site (NOAA NMFS, 2011).

The NRC staff also consulted with the U.S. Fish and Wildlife Service (USFWS) (NRC, 2011e). In response, the Chesapeake Bay Field Office of the USFWS concluded that two federally-listed threatened species [the Puritan tiger beetle (Cicindela puritana) and the northeastern beach tiger beetle (Cicindela dorsalis dorsalis)], occur on the Calvert Cliffs property, and that no critical habitat is designated for these species (USFWS, 2011).

3.8 Noise

Surveys conducted in support of UniStar's proposed Calvert Cliffs Unit 3 project demonstrate that sound levels at the Calvert Cliffs site are due largely to traffic traveling on MD SR 2/4 (CCNPP, 2010c). Furthermore, noise from the facility, including the ISFSI, is not audible off-site. While the surveys were conducted during the leaf-off season, CCNPP expects fully leafed trees to further reduce noise levels onsite and offsite during other parts of the year (CCNPP, 2010c).

3.9 Historical and Cultural Resources

As required by the National Historic Preservation Act (NHPA), the NRC is evaluating the impact of this renewal on historic, archaeological and traditional cultural resources. Archaeological investigations conducted in association with UniStar's proposed Calvert Cliffs Unit 3 project identified 1,029 previously surveyed, inventoried, and recorded cultural resources within a 16-km (10-mile) radius of the existing Calvert Cliffs site (CCNPP, 2010c). Additionally, the applicant identified four architectural resources on the Calvert Cliffs site (portions of the Baltimore and Drum Point Railroad prism, the abandoned YMCA Camp Conoy, Preston's Cliffs, and Parran's Park) and one archaeological site (a mid-nineteenth to early-twentieth-century domestic site centered on the remains of a stone foundation and containing diagnostic artifact and features) eligible for listing on the National Register of Historic Places (UniStar, 2009b). These sites are located outside the ISFSI facility footprint and areas of ISFSI operations and are shielded from views of the facility by the dense forest surrounding the ISFSI (CCNPP, 2010c).

Additionally, routes for two water-based historic trails pass by the site in the Chesapeake Bay. The Captain John Smith Chesapeake National Historic Trail, the nation's first water trail, follows the routes Captain John Smith took in 1608 when mapping the Chesapeake Bay and the rivers that feed it. As part of the Chesapeake Bay Gateways and Watertrails Network, it includes approximately 4,828 kilometers (3,000 miles) in the District of Columbia, Delaware, Maryland, and Virginia (Captain John Smith Chesapeake National Historic Trail, 2011). Part of the Captain John Smith Chesapeake National Historic Trail passes adjacent to the CCNPP site in the Chesapeake Bay and continues up the Patuxent River. The Star-Spangled Banner trail, although not completed, aims to provide the public with a water-based experience of the War of 1812 (National Park Service, 2011). While the current project areas focus on areas of the Patuxent River, the final route of the Star Spangled Banner trail also will pass through the Chesapeake Bay adjacent to the CCNPP site (National Park Service, 2010).

3.10 Visual and Scenic Resources

The major landscape feature near the affected area of the CCNP ISFSI is the Chesapeake Bay. Because the ISFSI is located inside the plant site protected area boundary, approximately 700 m (2300 feet) southwest of the nuclear power plant, 610 m (2000 feet) from the shoreline, and at an elevation of 35 m (114 feet) above mean sea level, recreational visitors are unable to see the ISFSI from the water (CCNPP, 2010c). In addition, the view of the site from MD SR 2/4 is obstructed by the heavily wooded and rolling topography of the site.

3.11 Public and Occupational Health

Risks to occupational health and safety include exposure to industrial hazards, hazardous materials, and radioactive materials. Industrial hazards for CCNPP are typical for similar industrial facilities and include exposure to chemicals and accidents ranging from minor cuts to industrial machinery accidents.

For a U.S. resident, the average annual estimated total effective dose equivalent (TEDE) from natural background and anthropogenic radiation sources is about 3.6 mSv [360 mrem] but varies by location and elevation (U.S. Department of Energy, 2008). The source of this dose includes cosmic radiation; radionuclides generated by interactions between the atmosphere and cosmic radiations (cosmogenic radionuclides), radiation sources in the earth (terrestrial sources), naturally-occurring radionuclides in the air (inhaled), and naturally-occurring radionuclides that exist in the body. Radiation levels in the vicinity of the ISFSI are shown in Table 2 of section 1.3.4.

4.0 ENVIRONMENTAL IMPACTS

In this chapter, the NRC staff presents its evaluation of the potential environmental impacts from the proposed continuation of ISFSI operation for 40 years and from reasonable alternatives to that proposed action. To assist in performing the evaluation, the NRC staff reviewed the CCNPP license renewal application and environmental report, reviewed the ISFSI monitoring information from the past 20 years of operation; collected information from federal and state government agencies, and collected information from tribal and African American organizations.

The NRC staff's evaluation of potential environmental impacts from the proposed action is based on (1) CCNPP's forecast of activities over the proposed 40-year renewal period, (2) data that reflects current site conditions, activities, and effluent levels, and (3) monitoring data collected over the previous 20 years of operation. As such, unless otherwise noted in the following discussion, the NRC staff is not relying on the analysis in the 1991 EA prepared for the initial licensing of the ISFSI (NRC, 1991) ("1991 licensing EA") as a basis for its conclusions.

The NRC staff used the guidance outlined in NUREG–1748 (NRC, 2003) in its evaluation. In accordance with this guidance, the staff evaluated the direct effects, indirect effects, and cumulative impacts that each resource area may encounter from the proposed action. The NRC staff categorized the effects in terms of small, moderate, or large as provided in NUREG-1748. The definitions for these terms are as follows:

- SMALL—environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource

- MODERATE—environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource

- LARGE—environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource

In its evaluation, the NRC staff assessed both the radiological and non-radiological impacts of the proposed action and the alternatives. As discussed in detail below, the NRC staff expects

that radiological doses to CCNPP workers and to the public from continued ISFSI operations would be below the NRC's regulatory limits in 10 CFR Part 20. Additionally, the NRC staff expects that non-radiological environmental impacts from continued ISFSI operations to all of the resource areas discussed below would be small, because (1) CCNPP is not requesting any construction beyond that previously approved, and (2) the ISFSI does not generate gaseous, liquid, or solid wastes. Table 5 compares the impacts expected from the proposed action, the no-action alterative, and the 20-year renewal alternative.

Table 5: Summary of Potential Environmental Impacts for the Proposed Action and Reasonable Alternatives

Resource Area	Proposed Action	20-year Renewal	No-Action Alternative
Land Use	SMALL	SMALL	SMALL
Transportation	SMALL	SMALL	SMALL
Socioeconomics	SMALL	SMALL	SMALL
Air Quality	SMALL	SMALL	SMALL
Geology and Soils	SMALL	SMALL	SMALL
Water Resources	SMALL	SMALL	SMALL to MODERATE
Ecology	SMALL	SMALL	SMALL
Noise	SMALL	SMALL	SMALL
Historical and Cultural	SMALL	SMALL	SMALL
Scenic and Visual	SMALL	SMALL	SMALL
Public and Occupational Health (Normal Operations)	SMALL	SMALL	SMALL
Public and Occupational Health (Accidents)	SMALL	SMALL	SMALL
Waste Management	SMALL	SMALL	SMALL

4.1 Land Use

In its license renewal request, CCNPP does not include any new construction that will disturb previously undisturbed land or any construction beyond that previously assessed in the NRC's 1991 licensing EA (NRC, 1991). Under NRC License SNM-2505, CCNPP is licensed to construct 120 HSMs on site; however, only 72 HSMs have been constructed to date.
As additional spent fuel storage is required in the future, CCNPP may have to expand the existing ISFSI pad to accommodate the additional 48 HSMs authorized by the current site-specific ISFSI license. The environmental impacts on land use from a 120 HSM ISFSI were addressed in the NRC staff's original licensing EA and determined to be minimal because construction activities would result in a loss of biological production of less than one percent of

the Calvert Cliffs site area (NRC, 1991). Continued storage of spent fuel in the ISFSI for the proposed 40-year license renewal period would not change the ISFSI's land use on site.

Long term operation of the ISFSI structure is not anticipated to require new and/or additional maintenance activities that would impact current land use, because the ISFSI structure is passive and requires little or no maintenance. Therefore, the NRC staff concludes that impacts on land use from the proposed action would be SMALL and would not be significant.

The no-action alternative could result in impacts to land use. In the short-term, ISFSI decommissioning activities may use land near the ISFSI to set up equipment and material staging areas. However, the NRC staff expects that these impacts on land use would be localized to the ISFSI area. Following ISFSI decommissioning, land could be returned to its use prior to ISFSI construction and operation (i.e., partially wooded and available for wildlife use). Despite these potential impacts on land use, the former ISFSI site would remain within the owner-controlled area at the Calvert Cliffs site, and for this reason, the NRC staff concludes that impacts on land use from the no-action alternative would be SMALL and would not be significant.

4.2 Transportation

The NRC staff expects that the proposed action would not change transportation at the CCNPP site. The proposed action does not request any construction or expansion of the existing ISFSI footprint beyond that previously approved, and no additional facility maintenance staff would be needed (CCNPP, 2010c). Movement of the DSCs from the spent fuel to the ISFSI would continue. Based on this information, the NRC staff concludes that the impacts on transportation from the proposed action would be SMALL and would not result in a significant impact.

The no-action alternative could increase traffic flow and transportation needed to move the spent fuel from the site. Decommissioning activities could increase the number of trucks entering and leaving the site. Additional transportation impacts would occur on the Calvert Cliffs site as the equipment needed to deconstruct the ISFSI and to transport materials away would move along onsite roads. Given the relatively high traffic volume on MD SR 2/4 (see Section 3.2), the NRC staff concludes that increase in traffic flow from decommissioning activities would not be detectable. Therefore, the NRC staff concludes that the impacts would be SMALL and would not be significant.

4.3 Socioeconomics

In its renewal application, CCNPP indicated that continued ISFSI operations will not require any additional employees to maintain and/or operate the ISFSI (CCNPP, 2010c). Therefore, the NRC staff does not expect any direct or indirect socioeconomic impacts and concludes that the socioeconomic impacts from the proposed action would be SMALL and would not result in a significant socioeconomic impact.

The no-action alternative will result in expiration of CCNPP's site-specific ISFSI license as of November 30, 2012. CCNPP would then need to conduct decommissioning of the ISFSI in accord with an NRC-approved plan as described in 10 CFR 72.54(d) and (g).
The decommissioning workforce may include a small number of additional workers for portions of the work. However, since the CCNPP Units 1 and 2 facility operating licenses continue until

2034 and 2036, respectively (NRC, 2000), and the majority of local employment is at the plant and not the ISFSI, the NRC staff expects that the impact of the ISFSI decommissioning upon the socioeconomics of Calvert County would be SMALL and would not be significant.

4.4 Air Quality

CCNPP's proposed action does not include any construction or ground-disturbance beyond that previously assessed in the NRC's 1991 licensing EA (NRC, 1991). As discussed in that EA, temporary increases in suspended particulates and the addition of exhaust emissions from construction equipment would be expected due to continued construction of the HSMs (NRC, 1991), but impacts should be minimal given that construction of the HSMs is staggered and only done when more storage space is needed. Moreover, by design, the dry spent fuel storage casks used at the ISFSI emit no gaseous effluents into the environment. The transfer trailer moving DSCs from the spent fuel pool to the ISFSI generate some exhausts, but the NRC staff expects such emissions to dissipate readily. As such, the NRC staff concludes that the impacts on air quality from the proposed action would be SMALL and would not result in a significant impact on air quality.

The no-action alternative may degrade the air quality in the vicinity of the ISFSI. The NRC staff expects that decommissioning activities would increase fugitive dust levels as a result of earth-moving activities, and equipment involved in building demolition and decommissioning would contribute exhaust emissions. Given the location of the ISFSI on the site, the NRC staff expects that offsite air quality would not be affected because dust and exhausts would be dissipated by local weather conditions. Therefore, the NRC staff concludes that impacts on air quality from the no-action alternative would be SMALL and would not be significant.

4.5 Geology and Soils

Under the proposed action, CCNPP would continue to expand the ISFSI to accommodate 120 HSMs. Construction, including earth clearing and foundation laying for the HSMs, could contribute to soil erosion. However, CCNPP would manage storm-water runoff and provide sediment control in accordance with local construction codes (NRC, 1991). Additionally, NRC staff does not expect continued ISFSI operation to impact the underlying geology, because the ISFSI has no moving parts that would impact the subsurface.

Although soils may be indirectly impacted by spills, leaks, or inadvertent discharges that flow uncontained into the ground, the ISFSI structure (dry cask) is designed to prevent against leakage under normal and accident conditions (CCNPP, 2010c). Therefore the potential for spills and leaks to be discharged into the ground is minimal. Additionally, the ISFSI structure is inspected daily, and spills or leaks are expected to be identified during the inspections and addressed.

Therefore, the NRC staff concludes that the impacts to geology and soils from the proposed action would be SMALL and would not result in a significant impact to such resources.

The no-action alternative may produce short-term impacts to soils. Decommissioning-related impacts would result from the disturbance of soil horizons as the ISFSI foundation is removed and from the leveling and re-grading of the ISFSI area following decommissioning (CCNPP, 1992). Additionally, soils found to be contaminated above NRC release levels would be shipped

offsite to an authorized disposal facility. Under 10 CFR Part 20, Subpart E ("Radiological Criteria for License Termination"), soils at the site would have to meet applicable radiological soil concentration limits before those areas could be released for restricted or unrestricted use. Following ISFSI decommissioning, CCNPP stated that it would re-grade the impacted soils consistent with the local topography and to reseed the soils to reduce soil erosion (CCNPP, 1992). The NRC staff expects that subsurface geology would not be impacted by ISFSI decommissioning because decommissioning activities would not extend to a depth to affect the geology. For these reasons, the NRC staff concluded that impacts on geology and soils from the no-action alternative would be SMALL and not significant.

4.6 Water Resources

Continued ISFSI operation would not change the water consumption at the CCNPP site, because CCNPP stated that it would continue to use the same operational and maintenance procedures during the renewal term. Additionally, the ISFSI does not consume water or generate liquid effluents during normal operation. During any spent fuel loading operation, water for cask decontamination is used within the confines of the Calvert Cliffs Station Auxiliary Building and would fall within the scope of water impacts previously assessed for reactor operations. Therefore, the NRC staff concludes that the direct impact on water resources from the proposed action would be SMALL and would not be significant.

The primary surface water bodies in the CCNPP site vicinity are the Chesapeake Bay and the Patuxent River. Additional onsite surface water bodies include several interconnected streams (Section 3.6.2). Indirect impacts to water quality can result from storm-water runoff incorporating grease, oil drips, and spills from operating equipment. However, CCNPP conducts regular preventative maintenance on the equipment used in transporting the spent fuel to the ISFSI (CCNPP, 2011f). Because of the preventative maintenance conducted by CCNPP, the NRC staff concludes that the indirect environmental impacts would be SMALL and would not result in a significant impact upon water resources.

The no-action alternative could impact water quality. Decommissioning activities that involve earth-moving activities could increase sediment runoff, but CCNPP may employ best management practices to reduce runoff and erosion. Additionally, should CCNPP conduct regular preventative maintenance on the decommissioning equipment, the NRC staff considers that such actions would reduce the potential for oil and grease spills from that equipment to impact surface waters. Therefore, if CCNPP were to employ best management practices and conduct preventative maintenance, the NRC staff concludes that impacts to water resources from the no-action alternative would be SMALL and would not be significant. If these measures were not implemented, the NRC staff concludes that the impacts would be SMALL to MODERATE.

4.7 Ecology

The license renewal and continued expansion of the ISFSI to accommodate 120 HSMs would not disturb any new land beyond the disturbances already assessed in the 1991 licensing EA. Given the presence of the ISFSI and regular activities associated with its operation, NRC staff expects that animals and birds would have either accustomed themselves to the ISFSI or to have relocated themselves away from the ISFSI due to ongoing operations. NRC staff expects that they will continue to do so as expansion of the ISFSI occurs. Therefore, the NRC staff

concludes that the impacts on ecological resources from the proposed action would be SMALL and thus would not result in a significant impact to such resources.

Under the no-action alternative, the ISFSI would be decommissioned in accordance with an NRC-approved decommissioning plan. NRC staff expects decommissioning activities, such as building demolition, to increase noise levels and change localized air quality as a result of fugitive dust and equipment exhaust emissions. As a result, animals and birds would likely avoid the activity area. The six-acre ISFSI area was previously disturbed by ISFSI construction, and so the expected ground disturbing, re-grading, and reseeding activities associated with decommissioning are not expected to substantially impact the local flora. Following decommissioning, as the vegetation re-establishes, local wildlife would likely re-inhabit the area, if the previous ISFSI area is not used for another CCNPP-related activity. Therefore, the NRC staff concludes that the impact on ecological resources from the no-action alternative would be SMALL and would not be significant.

4.7.1 Endangered and Threatened Species

NRC staff consulted with the federal and state agencies regarding the potential effects the proposed action may have on the ecology, particularly on endangered and threatened species (see Sections 3.7.3 and 5.0). Based on that consultation, the NRC determined that the proposed action would not adversely affect federally-listed threatened and endangered species, nor state-identified rare species or species of special concern, because none of these species are known to occur within the six-acre ISFSI facility or areas of operations, and no critical habitat for threatened or endangered species occurs on the Calvert Cliffs site. As noted previously in Section 3.7.3, threatened and endangered species are only known to be present in a portion of the Chesapeake Bay adjacent to the Calvert Cliffs site or on its shoreline and not in the vicinity of the ISFSI.

For the same reasons, the NRC staff concludes that any noise level or activity increases due to decommissioning the ISFSI under the no-action alternative would have minimal, if any, impact on these species. However, the NRC staff would further evaluate impacts to threatened and endangered species at the time of ISFSI decommissioning.

4.8 Noise

Aside from noise generated by the transfer trailer transporting the DSCs from the spent fuel pool to the ISFSI pad, activities associated with ISFSI operations generate no noise, because the structure has no moving parts. Additionally, as discussed in Section 3.8, noise from the ISFSI facility is not audible off-site. Therefore, the NRC staff concludes that the impact from noise generated as a result of the proposed action would be SMALL, and would not result in a significant noise impact.

The no-action alternative would be expected to cause short-term localized noise impacts. There would be increased noise from the decommissioning activities, such as building demolition and relocating the spent fuel casks to an alternate location. However, given the location of the ISFSI within the CCNPP site, offsite noise impacts from decommissioning would be limited. Therefore, the NRC staff concludes that impacts on noise levels from the no-action alternative would be SMALL and would not be significant.

4.9 Historical and Cultural Resources

As discussed in Section 3.9, identified historic and cultural sites are located outside the ISFSI facility footprint and areas of ISFSI operations and are shielded from views of the facility by the dense forest surrounding the ISFSI. Additionally, NRC consultation with the Maryland State Historic Preservation Officer and tribal community representatives have not identified historic or cultural resources that could be affected by the proposed action. Therefore, the NRC staff concludes that the impacts on historic and cultural resources from the proposed action would be SMALL and would not result in a significant impact to such resources.

The NRC staff concludes that impacts on historic and cultural resources from the no-action alternative would be SMALL and not significant for the same reasons as given for the proposed action.

4.10 Visual and Scenic Resources

The NRC staff does not anticipate any changes in the local or regional scenic quality as the scope of the proposed action does not include any new construction. Additionally, the CCNPP ISFSI is set back from and above the shoreline and shielded by rolling hills and trees, so the public is unable to see it from the Chesapeake Bay or from MD SR 2/4. Therefore, the NRC staff concludes that the impacts of the proposed action on scenic and visual resources would be SMALL and would not result in a significant impact to such resources.

Decommissioning activities carried out under the no-action alternative may cause localized short-term impacts to scenic and visual resources as the ISFSI structures are demolished. However, as discussed previously, the ISFSI site is not visible either from MD SR 2/4 or from the Chesapeake Bay, so there would be no significant impact on regional scenic and visual resources. Therefore, the NRC staff concludes that the overall impact on scenic and visual resources from the no-action alternative would be SMALL and would not be significant.

4.11 Public and Occupational Health

4.11.1 Non-Radiological Impacts

The CCNPP ISFSI has no moving parts, and therefore, no regular maintenance is expected. If needed, CCNPP performs maintenance operations on the transfer cask, transfer trailer, and other ancillary equipment in a low-radioactive dose environment when spent fuel is not being moved (CCNPP, 2010b). Preventative maintenance to this equipment includes changing the motor oil and replacing the hydraulic oil filter.

Because preventative maintenance at the ISFSI will be infrequent and minor, the NRC staff concludes that non-radiological impacts from maintenance operations under the proposed action would be SMALL and would not be significant.

Under the no-action alternative, potential impacts, such as total recordable incidents and recordable lost-time incidents,[1] could result from removal of the DSC from the HSMs, transfer of the DSCs to shipment casks, and demolition and dismantling of the ISFSI. CCNPP could implement existing procedures to reduce the likelihood of these incidents. If such procedures are in place, the NRC staff concludes that non-radiological impacts under the no-action alternative would be SMALL and would not be significant.

4.11.2 Radiological Impacts

10 CFR 72.44(d)(3)requires licensees to monitor and report annually on the principal radionuclides released to the environment in liquid and gaseous effluents during the previous 12 months of ISFSI operations. The staff reviewed CCNPP's annual radioactive effluent release reports from 1999 to 2010 and determined that the ISFSI has not released any radionuclides to the environment during that period of time. Based on these findings and the procedures for preventing radiological releases in place at the ISFSI, the NRC staff has determined that the proposed license renewal would have a SMALL and insignificant radiological impact on the environment.

4.11.2.1 Occupational Dose

CCNPP maintains a radiation protection program for the ISFSI in accordance with 10 CFR Part 20 to ensure that radiation doses are maintained as low as is reasonably achievable (ALARA). CCNPP's technical specifications establish dose rate limits of 0.20 mSv/hr (20 mrem/hr) for the HSM sides and 1.0 mSv/hr (100 mrem/hr) for the HSM doors and vents (CCNPP, 2010c). Because the CCNPP ISFSI structure is a passive system, it requires minimal maintenance during normal operation. During the storage phase, radiological impacts to workers will result from routine activities, such as performing radiation surveys, surveillance activities (when necessary) of the inlet and outlet vent of the HSMs, and routine security patrols. Such activities will be conducted by the existing workforce at the CCNPP.

Onsite workers are expected to receive a radiological dose during transfer of the DSC at the HSM. In the staff's 1991 EA (NRC, 1991), the estimated maximum occupational dose due to loading one DSC/HSM is 1.5 person/rem. The maximum annual occupational dose would depend on the number of DSCs loaded into HSMs for the year (i.e., 1.5 person/rem x number of DSC/HSM loadings).

Normal procedure for the daily inspection of HSM inlet and outlet vents involves the use of remote cameras to conduct the surveillance. In situations when a vent is partially or completely blocked, CCNPP workers manually remove the blockage (CCNPP, 2011d). Since 1993, CCNPP workers have removed blockages (caused either by snow or growing weeds) on four occasions (CCNPP, 2011d). The total estimated worker time for clearing the blockage on these occasions ranged from 1.4 to 3.2 person-hours, and the corresponding estimated cumulative occupational doses per event ranged from 0.0 mSv (0.0 mrem) to 0.0054 mSv (0.54 mrem) (CCNPP, 2011d). CCNPP also has estimated the occupational dose received by a worker needing a full 8 hours to clear a blockage (CCNPP, 2011f). The estimated occupational doses

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[1] Total recordable incidents are work-related deaths, illnesses, or injuries resulting in loss of consciousness, restriction of work or motion, transfer to another job, or required medical treatment beyond first aid. A lost-time incident is a recordable incident that results in one or more days away from work, days of restricted work activity, or both, for affected employees.

ranged from 4.9 mSv (488 mrem) for the NUHOMS-32P to 5.9 mSv (584 mrem) for the NUHOMS-24P (CCNPP, 2011f).

Onsite workers also receive a radiological dose when conducting security checks and in-person inspections of the ISFSI. As part of its amendment request to increase the ISFSI Technical Specification burnup limit from 47,000 gigawatt-days per metric ton uranium (GWd/MTU) to 52,000 GWd/MTU (CCNPP, 2009c), CCNPP modeled the radiological dose curves to bound a 120-HSM ISFSI fully loaded with DSCs composed of NUHOMS-24P, base NUHOMS-32P, and extended burnup NUHOMS-32P. These curves show that at the outer fenceline around the ISFSI (approximately 53 feet in an east-west direction, and 94 feet in a north-south direction from the HSMs), the dose is 0.01 mSv/hr (1 mrem/hr) or less, assuming continuous occupancy at the fenceline. Currently, with only 72 HSMs at the ISFSI site, dose rates would be expected to be less than the rates for a fully loaded ISFSI.

Since in all the above inspection and maintenance situations, employees would receive a radiological dose within the occupational dose limits specified in 10 CFR 20.1201, the NRC staff concludes that radiological impacts to CCNPP workers from the proposed action would be SMALL and would not be significant.

Under the no-action alternative, workers would likely receive minor radiological doses while removing the DSCs from the HSMs, and decontaminating and dismantling the ISFSI. Occupational annual radiological doses are expected to be below regulatory limits in 10 CFR 20.1201 given that CCNPP is required to have procedures in place to minimize doses to levels ALARA pursuant to 10 CFR 20.1101(b). For this reason, the NRC staff concludes that occupational radiological doses under the no-action alternative would be SMALL and would not be significant.

Under the 20-year renewal alternative, additional spent fuel assemblies would be loaded and spent fuel would continue to be stored at the CCNPP ISFSI. However, it is likely that the full number of currently approved HSMs (i.e., 120 HSMs) would not be built and therefore a reduced number of spent fuel assemblies would be stored in the ISFSI. Inspection of the ISFSI would be conducted as in the proposed action, and therefore, annual radiological doses to workers would be below those expected from the proposed action and below the annual limits in 10 CFR 20.1201. For this reason, potential radiological impacts to onsite workers from the 20-year renewal alternative would be SMALL and would not be significant.

4.11.2.2 Dose to the Public

Since no gaseous, solid, or liquid effluents are discharged from the CCNPP ISFSI structure, only direct and scatter gamma radiation from the HSMs contribute to potential radiological dose exposures to an offsite member of the public (CCNPP, 2010c). Assuming that all 120 HSMs are filled to capacity, the estimated maximum annual radiological dose to a member of the public continuously occupying the residence nearest the CCNPP ISFSI (approximately 1,434 m [4,705 ft] from the center of the ISFSI) is less than 0.02 mSv/yr (2 mrem/yr) (CCNPP, 2010b). Using the dose curves in CCNPP's amendment request to increase its burnup limit (CCNPP, 2009c), the annual radiological dose at the residence would be less than 0.0003 mSv/yr (0.03 mrem/yr). CCNPP estimates an additional radiological dose of less than 0.135 mSv/yr (13.5 mrem/yr) from the remaining uranium fuel cycle activities in the area (CCNPP, 2010c). NRC staff reviewed CCNPP's analyses and determined that the estimated annual radiological dose to the public due to ISFSI operations is below the regulatory limit of 1 mSv/yr (100 mrem/yr) in 10 CFR

20.1301(a) and below the 0.25 mSv/yr (25 mrem/yr) limit for an annual dose equivalent to the whole body in 10 CFR 72.104.

For these reasons, the NRC staff concludes that the potential radiological impacts to members of the public as a result of the proposed action are SMALL and would not be significant.

Under the no-action alternative, radiological doses to members of the public would be associated with removal of the DSCs from the HSMs and transfer of the spent fuel offsite. Offsite radiological exposures would be expected to be low given the distance of the decommissioning activities to the nearest offsite resident. For this reason, the NRC staff determined that such exposures, on an annual basis, would be less than the annual dose limit in 10 CFR 20.1302. Therefore the NRC staff concludes that the potential radiological impacts to members of the public from the no-action alternative would be SMALL and would not be significant.

Under the 20-year renewal alternative, additional spent fuel assemblies would be loaded and spent fuel would continue to be stored at the CCNPP ISFSI. However, it is likely that the full number of currently approved HSMs (i.e., 120 HSMs) would not be built and therefore a reduced number of spent fuel assemblies would be stored in the ISFSI. Therefore, the NRC staff concludes that annual radiological doses to members of the public would be below those expected from the proposed action and be below the annual limits in 10 CFR 20.1301. Therefore, potential radiological impacts to members of the public from the 20-year renewal alternative would be SMALL and would not be significant.

4.11.3 Accidents

CCNPP has evaluated the potential radiological impacts resulting from a suite of postulated accidents as part of its Safety Analysis Report (SAR) for the ISFSI (see CCNPP, 2011f). CCNPP is required under 10 CFR 72.70(c)(6) to update the SAR at least every 24 months from the date of issuance of the license.

Table 6 shows the postulated accidents and the aspects of the DSC / HSM that could be affected by each accident.

Table 6: Aspects of the ISFSI Design Potentially Affected by Postulated Accidents

Accident Load Type	DSC Shell Assembly	DSC Internal Basket	DSC Support Assembly	HSM	Transfer Cask
Loss of air outlet shielding					
Tornado winds				X	X
Tornado missiles				X	X
Earthquake	X	X	X	X	X
Flooding					
Transfer cask drop	X	X			X
Lightning strikes				X	
Blockage of air inlets and outlets	X	X	X	X	
DSC leakage					

Accident Load Type	DSC Shell Assembly	DSC Internal Basket	DSC Support Assembly	HSM	Transfer Cask
Accidental pressurization of DSC	X				
Forest fire				X	
Liquefied natural gas (LNG) plant or pipeline spill or explosion				X	
Modified from CCNPP, 2011f.					

Postulated accidents for the ISFSI include:

- Loss of air outlet shielding
- Tornado winds/tornado missiles
- Earthquake
- Flooding
- Transfer cask drop
- Lightning strikes
- Blockage of air inlets and outlets
- DSC leakage
- Accidental pressurization of DSC
- Forest fire
- LNG plant or pipeline spill or explosion

CCNPP found that two of these postulated accidents, loss of air outlet shielding and flooding, were not applicable to the CCNPP ISFSI. The HSM design prevents loss of air outlet shielding and the overall ISFSI design prevents flooding because the ISFSI is located 26 m [84 ft] above the maximum postulated flood elevation (CCNPP, 2010c). The remaining postulated accidents listed in CCNPP's environmental report for the license renewal (CCNPP, 2010c) are discussed below:

1. Tornado Winds / Tornado Missiles — CCNPP's analysis concluded that all components of the ISFSI are capable of safely withstanding tornado wind loads and tornado-generated missiles. As a result, CCNPP found that there is no accident dose associated with the design basis tornado (CCNPP, 2011f). The NRC staff determined that these results bound both the NUHOMS-24P and the NUHOMS-32P DSC designs and fuel with burnup rates up to 52 GWd/MTU. Therefore, the NRC staff concludes that the environmental impact of a tornado and tornado-generated missiles on the ISFSI would be SMALL and would not be significant.

2. Earthquake — CCNPP's analysis concluded that major components of the ISFSI have been designed and evaluated to withstand the forces generated by the design basis earthquake. The design basis seismic peak ground acceleration values used for the design of the ISFSI are 0.15g horizontal and 0.10g vertical (CCNPP, 2011f). The NRC staff reviewed CCNPP's findings and determined that no radiological dose consequences are expected from earthquake activity.

As discussed in Section 3.5.2, on August 23, 2011, a magnitude 5.8 earthquake occurred near Mineral, VA, in central Virginia, approximately 142 km (88 mi) from the Calvert Cliffs site (Unistar, 2011), with intensities at the CCNPP site categorized as "weak" and ground acceleration lower than 0.05g (USGS, 2011). This acceleration was below the peak ground acceleration values used for the ISFSI design. CCNPP did not identify any impacts on the ISFSI from this earthquake.

Additionally, based on both test borings at the ISFSI site and laboratory tests, the NRC staff does not anticipate significant potential for soil liquefaction resulting from off-site seismicity (NRC, 1991). Therefore, the NRC staff expects that future seismicity would not adversely affect ISFSI operation during the proposed 40-year renewal period.

Therefore, the NRC staff concludes that the environmental impact of an earthquake on the ISFSI would be SMALL and would not be significant.

3. Transfer Cask Drop — CCNPP's analyses show that the transfer cask, the NUHOMS-32P DSC, its internal basket assembly, and the contained fuel will maintain their structural integrity in the event of a cask drop. For the purposes of evaluation, however, CCNPP analyzed the loss of the entire neutron shielding due to the design drop accident. CCNPP determined that an onsite worker located 15 feet from the cask for an 8-hour period would receive a radiological dose of 10.2 mSv (1021 mrem) from the NUHOMS-32P DSC and a dose of 11.64 mSv (1164 mrem) for the NUHOMS-32P high burnup fuel. NRC staff reviewed CCNPP's analyses and determined that these doses are below the limit of 0.05 Sv (5 rem) [50 mSv or 5000 mrem] for an individual located on the nearest boundary of the controlled area in 10 CFR 72.106(b). Therefore, the NRC staff concludes that the environmental impact of a cask transfer drop would be SMALL and would not be significant.

4. Lightning Strikes — CCNPP's analysis concluded that no off-normal operating condition would develop as a result of lightning striking in the vicinity of the ISFSI. Therefore, CCNPP does not expect that radiological doses would occur as a result (CCNPP, 2011f). CCNPP stated that its conclusion is applicable to both DSC designs, as well as for the DSCs loaded with the higher burnup fuel. NRC staff reviewed CCNPP's analyses and determined lightning strikes would not create a situation in which radiological doses would occur. Therefore, the NRC staff concludes that the environmental impact of lightning strikes on the ISFSI would be SMALL and would not be significant.

5. Blockage of Air Inlets and Outlets — CCNPP's analysis concluded that there would be no radiological impacts to members of the public, but that occupational radiological doses would be incurred during onsite operations to clear the blockage (CCNPP, 2011f). NRC staff determined that these estimated occupational doses, if received over an 8-hour period, would be approximately 10% of the limits for a design-basis accident in 10 CFR 72.106(b) [see in Section 4.11.2.1]. Therefore, the NRC staff concludes that the environmental impact of blocked air inlets and outlets would be SMALL and would not be significant.

6. DSC Leakage —The design of the NUHOMS system precludes the possibility of all fuel rods rupturing concurrently with leakage of the DSC (CCNPP, 2011f). However, for the purposes of evaluating this postulated accident, CCNPP assumed that the fuel rods and the DSC pressure boundary were ruptured during the hypothetical event. Whole body

and maximum organ doses were calculated for the hypothetical individual assumed to be present at the nearest controlled area boundary location (approximately 3,900 feet from the facility) for the duration of the event. The resulting calculated doses for the NUHOMS-24P were 0.0001 mSv (0.1 mrem) for the maximum off-site total body dose and 0.18 mSv (17.8 mrem) for the maximum off-site skin dose. For the NUHOMS-32P, CCNPP used the same methodology except a 24-month operating cycle was assumed. CCNPP found that the calculated doses were 0.004 mSv (0.36 mrem) for the total body dose and 0.6 mSv (60.1 mrem) for the off-site skin dose. The calculated doses for the NUHOMS-32P high burnup fuel were 0.007 mSv (0.65 mrem) for the total body dose, and 1.1 mSv (109.6 mrem) for the skin dose (CCNPP, 2011f). The calculated offsite radiological doses for both designs and the high burnup fuel are well within the 10 CFR 72.106 limit of 0.05 Sv (5 rem) (CCNPP, 2011f). The NRC staff reviewed CCNPP's findings and determined that the expected doses are within regulatory limits. Therefore, the NRC staff concludes that the environmental impact from the leakage of a DSC would be SMALL and would not be significant.

7. Accidental Pressurization of DSC — CCNPP's analysis indicated that, for both DSC designs as well as for the DSCs loaded with the higher burnup fuel, the maximum DSC accident pressure is within the design basis limits and that therefore, no radiological dose consequence would result from the effects of accidental pressurization (CCNPP, 2011f). The NRC staff reviewed CCNPP's findings and determined that accidental pressurization would not result in any radiological dose consequences. For this reason, the NRC staff concludes that the environmental impact of the accidental pressurization of a DSC would be SMALL and would not be significant.

8. Forest Fire — CCNPP's analysis concluded that, for both DSC designs as well as for the DSCs loaded with the higher burnup fuel, there are no radiological dose consequences associated with the postulated forest fire accident (CCNPP, 2011f). This analysis showed that, although the outer few inches of the HSM walls may crack and spall as a result of the fire, the remaining wall thickness would remain within design temperature limits and the load capacity of the HSM walls would not be affected. Additionally, fuel cladding temperature limits and DSC internal pressure limits would not be exceeded. An increase in the HSM surface dose from 0.14 mSv/hr (13.5 mrem/hr) to approximately 0.6 mSv/hr (60.4 mrem/hr) would not adversely impact necessary repair activities, and CCNPP's actions to mitigate the fire and repair the HSMs would limit off-site dose consequences so that they would remain with the design-accident limits in 10 CFR 72.106. The NRC staff reviewed CCNPP's analysis and determined that there are no radiological dose consequences associated with the postulated forest fire accident for the reasons established by CCNPP. Therefore, the NRC staff concludes that the environmental impact of a forest fire on the ISFSI would be SMALL and would not be significant.

9. LNG Plant or Pipeline Spill or Explosion — CCNPP's analysis concluded that operation of the nearby Cove Point LNG facility, including spills and explosions, would not present any undue hazards to Calvert Cliffs or to the ISFSI (CCNPP, 2011f). That analysis examined seven scenarios, the likelihood that any of those scenarios would occur and result in an LNG release (either in gaseous or liquefied form), and the corresponding consequences to safety at the CCNPP site if the released gas ignited. The NRC staff previously evaluated CCNPP's analysis and found its conclusions acceptable (NRC, 1995). The NRC staff determined that its prior evaluation is still relevant and therefore

concludes that the environmental impact of a LNG plant or pipeline spill or explosion on the ISFSI would be SMALL and would not be significant.

Under the no-action alternative, the likelihood of any of these postulated accidents would be reduced as the ISFSI is dismantled. Additionally, since the NRC staff expects the impacts from these postulated accidents to be SMALL during continued ISFSI operations, the NRC staff concludes that the impacts from accidents under the no-action alternative also would be SMALL and would not be significant.

4.12 Waste Management

Waste generated as a result of loading operations and transfer cask decontamination may be liquid (from decontamination of transfer cask), gaseous (from loading and seal welding the DSC) and/or solid (from protective clothing utilized and all tools and material used during a loading and transfer campaign). These radioactive wastes are managed by CCNPP's existing on-site waste-processing systems (CCNPP, 2010c).

Contaminated pool water removed from loading DSCs is normally drained back into the spent fuel pool with no additional processing. Liquid generated during decontamination of the transfer cask is collected in the cask washdown pit. This liquid waste is then directed to the power plant liquid waste processing system.

Potentially contaminated air and helium that are purged from the DSC following DSC loading and seal welding operation are directed to the Auxiliary Building ventilation system.

Small quantities (less than 2 cubic feet per DSC) of low-level solid radioactive waste generated during the DSC loading and transfer cask decontamination are processed by compaction using the power plant solid waste processing system. This low-level radioactive waste consists of disposable Anti-C garments, tapes, and decontamination cloths, among other things.

Because existing CCNPP programs and/or systems are in place to manage waste generated from activities associated with ISFSI operations, and the proposed action will not modify current ISFSI operation-related activities, the NRC staff concludes that the impacts of the proposed action on waste management would be SMALL and would not be significant.

The no-action alternative may result in short-term waste impacts due to the temporary activities associated with decommissioning (e.g., building demolition and spent fuel relocation). Following removal of the DSCs, CCNPP stated that they anticipate only the inner approximately 15.2 cm (6 inches) of the HSMs would be contaminated due to the neutron flux emanating from the DSCs (CCNPP, 1992). As discussed above, the HSMs have 3-foot thick walls and sit on a concrete foundation. CCNPP anticipates removing the contaminated interior portions of the HSMs to be disposed in a low-level radioactive waste disposal facility. The rest of the HSM and the concrete foundation would be demolished, rubble-ized, and then disposed in a non-radioactive, conventional manner (CCNPP, 1992). Additionally, the NRC staff expects CCNPP to conduct a radiological survey of the HSMs, ISFSI pad, and soils within the ISFSI area as required by 10 CFR 72.54(l)(2) to demonstrate that the site is suitable for release in accordance with the criteria for decommissioning in 10 CFR Part 20 Subpart E. Affected soils would potentially have to be disposed of at an off-site low-level radioactive waste disposal facility to

meet those requirements. However, due to this expectation that only a limited portion of the HSMs and potentially some soils would require off-site disposal at a low-level radioactive waste disposal facility, the NRC staff expects the receiving waste disposal facilities would have sufficient available capacity to handle these ISFSI waste materials. Non-radioactive wastes would be disposed of at existing nearby landfills. Therefore, the NRC staff concludes that the impacts of the no-action alternative on waste management would be SMALL and would not be significant.

Waste management activities performed under the 20-year renewal alternative would be the same as those performed under the proposed action. However under this alternative, a smaller amount of waste would be generated and handled. Existing CCNPP programs and/or systems are used to manage the waste generated by ISFSI activities. Therefore, the NRC staff concludes that potential environmental impacts from waste management under the 20-year license renewal alternative would be SMALL and would not be significant.

4.13 Cumulative Impacts

The NRC staff evaluated whether cumulative environmental impacts could result from the incremental impact of the proposed action when added to the past, present, or reasonably foreseeable future actions in the area.

As discussed previously in this EA, there are other on-going and potential future activities occurring in the vicinity of the CCNPP ISFSI. These include: (1) Calvert Cliffs operating Units 1 and 2 nuclear power plants; (2) the proposed Calvert Cliffs Unit 3 nuclear power plant; (3) the Naval Air Station Patuxent River; (4) the Dominion Cove Point liquid natural gas (LNG) import facility; (5) transportation along MD SR 2/4; and (6) recreational activities at Flag Ponds Nature Park, Calvert Cliffs State Park, and in the Chesapeake Bay. Dominion Resources Inc. (Dominion) is seeking to convert the Cove Point LNG facility to an export facility, filing its application to do so with the U.S. Department of Energy (DOE) on October 3, 2011 (DOE, 2012). Dominion estimates an average of 750 workers would be employed during three-plus years of construction, which is expected to begin in 2014 (Dominion, 2012). These current and potential future activities have impacts on the local land use, transportation, air quality, noise levels, ecological and scenic/visual resources. Additionally, Calvert Cliffs Units 1 and 2 and the proposed Unit 3 contribute and could contribute to the radiological dose received by members of the public beyond that which is received from the natural environment.

As discussed above, NRC staff determined that impacts from the proposed action would be SMALL for all resource areas. This is due to the passive nature of the ISFSI in that it emits no gaseous or liquid effluents during operation. Also, the ISFSI is designed to minimize radiological doses to workers and members of the public. Finally, the ISFSI is located at a distance sufficient from both the Chesapeake Bay and MD SR 2/4, in wooded, rolling topography, so as to minimize its impact on air quality, noise levels, federally-listed threatened and endangered species, and scenic/visual resources. Since the NRC staff determined that the ISFSI itself has no significant impact on environmental resources, the NRC staff concludes that the proposed action would have a SMALL incremental contribution to cumulative impacts on environmental resources that would not be significant.

The NRC staff also evaluated whether cumulative environmental impacts could result from the incremental impact of the alternatives to the proposed action (i.e., the no-action alternative and

the 20-year renewal alternative) when added to the past, present, or reasonably foreseeable future actions in the area. The other on-going and potential future activities in the vicinity of the CCNPP ISFSI are discussed above. Likewise, as discussed above, the NRC staff determined that all of the impacts from the alternatives to the proposed action would be SMALL and would not be significant, except for potential impacts to water resources during decommissioning,. Therefore, the NRC staff concludes that in all situations aside from the one singled out above, the alternatives to the proposed action would have a SMALL incremental contribution to cumulative impacts on environmental resources that would not be significant. If the licensee conducted ISFSI decommissioning under the no-action alternative and did not take the mitigative measures described above in Section 4.6, the impacts to water resources would be SMALL to MODERATE and the incremental contribution to cumulative impacts on water resources would also be SMALL to MODERATE.

5.0 AGENCIES AND PERSONS CONSULTED

The NRC staff consulted with other agencies regarding the proposed action in accordance with NUREG–1748. These consultations are intended to (i) ensure that the requirements of Section 7 of the Endangered Species Act (ESA) and Section 106 of the National Historic Preservation Act (NHPA) are met; (ii) fulfill NRC's requirements in meeting the provisions of Section 307 of the Coastal Zone Management Act of 1972, as amended; and (iii) provide the designated state liaison agencies the opportunity to comment on the proposed action.

5.1 Maryland Historic Trust

In accordance with Section 106 of the NHPA, by letter dated March 31, 2011, the NRC staff requested input from the State Historic Preservation Officer regarding identification of historic properties that may be affected by the proposed action (NRC, 2011d). In its response of April 27, 2011, the Maryland Historic Trust (MHT) stated that there are no historic properties that would be affected by continued operation of the CCNPP ISFSI (MHT, 2011).

5.2 U.S. Fish and Wildlife Service

In accordance with Section 7 of the ESA, by letter dated March 31, 2011, the NRC staff requested that the U.S. Fish and Wildlife Service (USFWS) provide a list of endangered or threatened species or their critical habitat that may be affected by the proposed action (NRC, 2011e). In response, the Chesapeake Bay Field Office of the USFWS stated that two federally-listed threatened species [the Puritan tiger beetle (*Cicindela puritana*) and the northeastern beach tiger beetle (*Cicindela dorsalis dorsalis*)], occur on the Calvert Cliffs property, and that no critical habitat is designated for these species. However, based on the distance of the ISFSI from the shoreline habitats of these tiger beetle species, the USFWS concurred with the NRC staff conclusion that renewal of the ISFSI license is not likely to adversely affect these species (USFWS, 2011).

5.3 National Oceanic and Atmospheric Administration - National Marine Fisheries Service

In accordance with Section 7 of the ESA, by letter dated March 31, 2011, the NRC staff requested that NOAA's NMFS provide a list of endangered or threatened marine species or their critical habitat that may be affected by the proposed action (NRC, 2011f). In its response

of April 15, 2011 (NOAA NMFS, 2011), NOAA's NMFS identified the presence of the shortnose sturgeon (*Acipenser brevirostrum*), the Atlantic sturgeon, and several species of sea turtles in the Chesapeake Bay adjacent to the Calvert Cliffs site. However, NOAA's NMFS concluded that no effects from continued operation of the CCNPP ISFSI to these species were likely to result, given that the ISFSI would not affect the Chesapeake Bay where identified species were known to occur.

5.4 Maryland Department of the Environment

By letter dated March 31, 2011, the NRC staff requested input from the Maryland Department of the Environment (MDE) on the proposed action, particularly with respect to land, air, and water resources (NRC, 2011b). In its response of May 19, 2011, the MDE stated its conclusion that the incremental contribution of radioactivity and the corresponding radiological dose attributable to the operation of the ISFSI was minimal when compared with natural levels of radioactivity and the associated natural radiological dose, and that the MDE had no reason to challenge the continued operation of the CCNPP ISFSI (MDE, 2011).

5.5 Maryland Department of Natural Resources

By letter dated March 31, 2011, the NRC staff requested that the Maryland Department of Natural Resources (MDNR) provide State-listed, proposed, and candidate species and their critical habitat that may be affected by the proposed action (NRC, 2011c). In its September 19, 2011 response, MDNR stated that a recent evaluation of the CCNPP site for the proposed Calvert Cliffs Unit 3 review did not identify rare, threatened, or endangered species located near the ISFSI site, and that MDNR therefore had no comment on potential impacts to such species from the proposed action (MDNR, 2011).

By letter dated March 27, 2012, the NRC staff provided a copy of the staff's pre-decisional draft EA to MDNR for its review and comment (NRC, 2012). In its April 25, 2012 reply, MDNR stated that it had no comments on the draft EA, finding that the NRC staff's evaluation was comprehensive and complete and that MDNR agreed with the staff's conclusions (MDNR, 2012).

5.6 Native American Indian Tribes

On March 31, 2011, in accordance with Section 106 of the NHPA, the NRC staff sent consultation letters to the Piscataway Conoy Confederacy and Subtribes (NRC, 2011g) and to the Cedarville Band of Piscataway Indians (NRC, 2011h). On May 5, 2011, the NRC staff sent a consultation letter to the Piscataway Indian Nation (NRC, 2011j). The letters asked the tribes to identify historic properties or cultural resources on the Calvert Cliffs site. They were also invited to raise any concerns they had regarding the proposed action. Following transmittal of these letters, the NRC staff contacted representatives for each of these tribes by telephone. Two representatives expressed no concerns, while the third raised issues related to aging of the spent fuel and of the ISFSI (NRC, 2012a; 2012b; 2012c). Aging management issues are addressed in the NRC staff's SER and not within the scope of this EA.

5.7 Maryland Commission on African American History and Culture

By letter dated March 31, 2011, the NRC staff requested any information that the Maryland Commission on African American History and Culture might have on historic properties or cultural resources that might be affected by the proposed action (NRC, 2011i). Following transmittal of this letter, the NRC staff contacted a representative for the Commission by telephone. No issues were identified by the Commission representative in that call (NRC, 2012d).

5.8 Consistency Determination Regarding the Coastal Zone Management Act of 1972

Pursuant to Section 307(c)(3) of the Coastal Zone Management Act of 1972, as amended (16 U.S.C. § 1456), CCNPP provided documentation to the NRC of the State of Maryland's determination that the proposed action is consistent with the State's Coastal Zone Management Program (CZMP). The State of Maryland determined that renewal of the ISFSI operating license is consistent with the Maryland CZMP, and that the State concurs with CCNPP's certification to that effect (CCNPP, 2011d).

6.0 CONCLUSION

Based on its review of the proposed action, in accordance with the requirements in 10 CFR Part 51, the NRC staff has determined that renewal of NRC license SNM-2505, authorizing continued operation of CCNPP's site-specific ISFSI for a period of 40 years, will not significantly affect the quality of the human environment. In its license renewal request, CCNPP is proposing no changes in how it handles or stores spent fuel at the ISFSI, and no significant changes in CCNPP's authorized operations for the ISFSI are planned during the proposed license renewal period. Approval of the proposed action is not expected to result in any new construction or expansion of the existing ISFSI footprint beyond that previously approved. The ISFSI is a passive facility that produces no liquid or gaseous effluents and requires no power or regular maintenance. No significant radiological or non-radiological impacts are expected from continued normal operations. Occupational dose estimates from routine monitoring activities and transfer of spent fuel for disposal are expected to be maintained ALARA and are expected to be within the limits of 10 CFR 20.1201. The estimated annual dose to the nearest potential member of the public from ISFSI activities is less than 0.02 mSv/yr (2 mrem/yr), which is significantly less than limits specified in 10 CFR 72.104 and 10 CFR 20.1301(a). For these reasons, the NRC has determined that pursuant to 10 CFR 51.31, preparation of an Environmental Impact Statement is not required for the proposed action, and pursuant to 10 CFR 51.32, a Finding of No Significant Impact is appropriate.

7.0 LIST OF PREPARERS

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8.0 REFERENCES

References are organized alphabetically by author or organization. For those authors or organizations with multiple references, the references are then organized chronologically, with the oldest reference first. Progressively more recent references then follow, each preceded by "———." to indicate their relation to the previously identified author or organization.

40 CFR 81. Code of Federal Regulations, Title 40, *Protection of Environment*, Part 81, "Designation of Areas for Air Quality Planning Purposes."

Armbruster, J. and Seeber, L. 1987. *The 23 April 1984 Martic Earthquake and The Lancaster Seismic Zone in Eastern Pennsylvania*, Bulletin of the Seismological Society of America, Volume 77, Number 2, p 877-890.

Baltimore Gas and Electric Company (BGE). 2000. "Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318 Calvert Cliffs Independent Spent Fuel Storage Installation, Docket No. 72-8 Radiological Environmental Monitoring Program Annual Report." Letter (May 1) to Document Control Desk (NRC). ADAMS Accession No. ML003712463.

Board of Education of Calvert County (BECC). 2010. "Calvert County Public Schools 2010 Annual Report," November 2010.

Bollinger, G. and Sibol, M. 1985. *Seismic Reflection Studies, Gravity and Geology of the Central Virginia Seismic Zone: Part I. Seismicity*, Geological Society of America Bulletin, Volume 96, 49-57, January 1985.

Calvert County Board of County Commissioners (CCBCC). 2010. "Comprehensive Plan Calvert County, Maryland," October 2010.

Calvert Cliffs Nuclear Power Plant, Inc. (CCNPP). 1992. "Decommissioning Plan for Calvert Cliffs ISFSI." Rev. 1. Legacy ADAMS Accession No. 9208200003. August 18, 1992.

———. "Calvert Cliffs Nuclear Power Plant Independent Spent Fuel Storage Installation Docket No. 72-8 Radioactive Effluent Release Report." Letter (February 4) to Document Control Desk (NRC). ADAMS Accession No. ML003681141. 2000a.

———. "Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318 Calvert Cliffs Independent Spent Fuel Storage Installation, Docket No. 72-8 Radiological Environmental Monitoring Program Annual Report." Letter (May 1) to Document Control Desk (NRC). ADAMS Accession No. ML003712463. 2000b.

———. "Calvert Cliffs Nuclear Power Plant Independent Spent Fuel Storage Installation Docket No. 72-8 Radioactive Effluent Release Report." Letter (February 7) to Document Control Desk (NRC). ADAMS Accession No. ML010440313. 2001a.

———. "Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318 Calvert Cliffs Independent Spent Fuel Storage Installation, Docket No. 72-8 Radiological Environmental Monitoring Program Annual Report." Letter (May 9) to Document Control Desk (NRC). ADAMS Accession No. ML011340212. 2001b.

———. “Calvert Cliffs Nuclear Power Plant Independent Spent Fuel Storage Installation Docket No. 72-8 Radioactive Effluent Release Report.” Letter (May 10) to Document Control Desk (NRC). ADAMS Accession No. ML021350199. 2002a.

———. “Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318 Calvert Cliffs Independent Spent Fuel Storage Installation, Docket No. 72-8 Radiological Environmental Monitoring Program Annual Report.” Letter (May 10) to Document Control Desk (NRC). ADAMS Accession No. ML021350439. 2002b.

———. “Calvert Cliffs Nuclear Power Plant Independent Spent Fuel Storage Installation Docket No. 72-8 Radioactive Effluent Release Report.” Letter (January 30) to Document Control Desk (NRC). ADAMS Accession No. ML030350264. 2003a.

———. “Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318 Calvert Cliffs Independent Spent Fuel Storage Installation, Docket No. 72-8 Radiological Environmental Monitoring Program Annual Report.” Letter (May 15) to Document Control Desk (NRC). ADAMS Accession No. ML031400478. 2003b.

———. “Calvert Cliffs Nuclear Power Plant Independent Spent Fuel Storage Installation Docket No. 72-8 Radioactive Effluent Release Report.” Letter (January 29) to Document Control Desk (NRC). ADAMS Accession No. ML040340210. 2004a.

———. “Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318 Calvert Cliffs Independent Spent Fuel Storage Installation, Docket No. 72-8 Radiological Environmental Monitoring Program Annual Report.” Letter (May 12) to Document Control Desk (NRC). ADAMS Accession No. ML041380033. 2004b.

———. “Calvert Cliffs Nuclear Power Plant Independent Spent Fuel Storage Installation Docket No. 72-8 Radioactive Effluent Release Report.” Letter (January 27) to Document Control Desk (NRC). ADAMS Accession No. ML050330110. 2005a.

———. “Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318 Calvert Cliffs Independent Spent Fuel Storage Installation, Docket No. 72-8 Radiological Environmental Monitoring Program Annual Report.” Letter (May 13) to Document Control Desk (NRC). ADAMS Accession No. ML051370609. 2005b.

———. “Calvert Cliffs Nuclear Power Plant Independent Spent Fuel Storage Installation Docket No. 72-8 Radioactive Effluent Release Report.” Letter (January 30) to Document Control Desk (NRC). ADAMS Accession No. ML060320213. 2006a.

———. “Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318 Calvert Cliffs Independent Spent Fuel Storage Installation, Docket No. 72-8 Radiological Environmental Monitoring Program Annual Report.” Letter (May 15) to Document Control Desk (NRC). ADAMS Accession No. ML061440213. 2006b.

———. “Calvert Cliffs Nuclear Power Plant Independent Spent Fuel Storage Installation Docket No. 72-8 Radioactive Effluent Release Report.” Letter (January 24) to Document Control Desk (NRC). ADAMS Accession No. ML070260068. 2007a.

———. “Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318 Calvert Cliffs Independent Spent Fuel Storage Installation, Docket No. 72-8 Radiological Environmental Monitoring Program Annual Report.” Letter (May 10) to Document Control Desk (NRC). ADAMS Accession No. ML071590393. 2007b.

———. “Calvert Cliffs Nuclear Power Plant Independent Spent Fuel Storage Installation Docket No. 72-8 Radioactive Effluent Release Report.” Letter (February 27) to Document Control Desk (NRC). ADAMS Accession No. ML080600373. 2008a.

———. “Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318 Calvert Cliffs Independent Spent Fuel Storage Installation, Docket No. 72-8 Radiological Environmental Monitoring Program Annual Report.” Letter (May 13) to Document Control Desk (NRC). ADAMS Accession No. ML081400302. 2008b.

———. “Calvert Cliffs Nuclear Power Plant Independent Spent Fuel Storage Installation Docket No. 72-8 Radioactive Effluent Release Report.” Letter (January 28) to Document Control Desk (NRC). ADAMS Accession No. ML090280522. 2009a.

———. “Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318 Calvert Cliffs Independent Spent Fuel Storage Installation, Docket No. 72-8 Radiological Environmental Monitoring Program Annual Report.” Letter (May 15) to Document Control Desk (NRC). ADAMS Accession No. ML091410278. 2009b.

———. “CCNPP Calculation, ‘Horizontal Storage Module Dose Rates for ISFSI 32P Burnup Extension,’ Document No. CA06751, Revision No. 0,” June 2009. ADAMS Accession No. ML091680545. 2009c.

———. “Calvert Cliffs Nuclear Power Plant Independent Spent Fuel Storage Installation Docket No. 72-8 Radioactive Effluent Release Report.” Letter (January 26) to Document Control Desk (NRC). ADAMS Accession No. ML100320427. 2010a.

———. “Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318 Calvert Cliffs Independent Spent Fuel Storage Installation, Docket No. 72-8 Radiological Environmental Monitoring Program Annual Report.” Letter (May 14) to Document Control Desk (NRC). ADAMS Accession No. ML101380321. 2010b.

———. “Site-Specific Independent Spent Fuel Storage Installation (ISFSI) License Renewal Application.” Letter (September 17) to Document Control Desk (NRC). ADAMS Accession No. ML102650247. 2010c.

———. “Responses to Request for Supplemental Information, Re: Calvert Cliffs Independent Spent Fuel Storage Installation License Renewal Application.” Letter (February 10) to Document Control Desk (NRC). ADAMS Accession No. ML110620120. 2011a.

———. “Calvert Cliffs Nuclear Power Plant Independent Spent Fuel Storage Installation Docket No. 72-8 Radioactive Effluent Release Report.” Letter (February 25) to Document Control Desk (NRC). ADAMS Accession No. ML110470401. 2011b.

———. “Calvert Cliffs Nuclear Power Plant; Unit Nos. 1 & 2; Docket Nos. 50-317 & 50-318 Independent Spent Fuel Storage Installation; Docket No. 72-8 Annual Radiological Environmental Operating Report.” Letter (May 13) to Document Control Desk (NRC). ADAMS Accession No. ML11137A172. 2011c.

———. “Responses to Request for Additional Information, RE: Calvert Cliffs Independent Spent Fuel Storage Installation License Renewal Application.” Letter (June 14) to Document Control Desk (NRC). ADAMS Accession No. ML11167A014. 2011d.

———. “Responses to Request for Additional Information, RE: Calvert Cliffs Independent Spent Fuel Storage Installation License Renewal Application.” Letter (June 28) to Document Control Desk (NRC). ADAMS Accession No. ML11180A270. 2011e.

———. “Calvert Cliffs Independent Spent Fuel Storage Installation Updated Safety Analysis Report.” Revision 20. Transmitted by letter (September 8) to Document Control Desk (NRC). ADAMS Accession No. ML112690208. 2011f.

———. “Response to Second Request for Additional Information for Renewal Application to Special Nuclear Materials License No. 2505 for the Calvert Cliffs Site Specific Independent Spent Fuel Storage Installation.” Letter (December 15) to Document Control Desk (NRC). ADAMS Accession No. ML11364A024. 2011g.

Captain John Smith Chesapeake National Historic Trail, 2011. http://www.smithtrail.net/. Accessed on September 14, 2011.

Chesapeake Bay Gateways Network, 2011. http://www.baygateways.net/general.cfm?id=123). Accessed on September 14, 2011.

Dominion Resources Inc. (Dominion), 2012. “Dominion Confident Sierra Club Objections Will Not Block Cove Point Liquefaction Project.” April 26, 2012 News Release. http://dom.mediaroom.com/index.php?s=26677&item=127447. Accessed on April 30, 2012.

Electric Power Research Institute (EPRI). 1986. *Seismic Hazard Methodology for the Central and Eastern United States*, EPRI Report NP-4726. July 1986.

Kim, W. and Chapman, M., 2005. *The 9 December 2003 Central Virginia Earthquake Sequence: A Compound Earthquake in the Central Virginia Seismic Zone*, Bulletin of the Seismological Society of America, Volume 95, Number 6, p 2428-2445.

Maryland Department of Environment (MDE), 2011. Letter (May 19) to D. Diaz-Toro (NRC). ADAMS Accession No. ML111450213.

Maryland Department of Labor, Licensing and Regulation (DLLR), 2010. “Calvert County – Major Employer Lists – (Listed Alphabetically).” http://www.dllr.state.md.us/lmi/emplists/calvert.shtml.

———. “Employment, Unemployment and Unemployment Rate by Place of Residence (LAUS).” http://www.dllr.state.md.us/lmi/laus/. 2011.

Maryland Department of Natural Resources (MDNR), 2010. "Current and Historical Rare, Threatened, and Endangered Species of Calvert County, Maryland." Wildlife and Heritage Service. http://dnr.maryland.gov/wildlife/Plants_Wildlife/rte/pdfs/rtecalvert.pdf. April 2010.

———. "Request for Information for the Environmental Review of the Proposed 40-Year License Renewal for Calvert Cliffs Independent Spent Fuel Storage Installation." Letter (September 16) to D. Diaz-Toro (NRC). ADAMS Accession No. ML112770387. 2011.

———. Letter (April 25) to K. Hsueh (NRC). ADAMS Accession No. ML121180580. 2012.

Maryland Department of Planning, 2010. "Historical and Projected Total Population for Maryland's Jurisdictions." Maryland State Data Center. Revisions, November 2010. http://www.mdp.state.md.us/msdc/popproj/TOTPOP_PROJ07.pdf.

Maryland Department of Transportation, 2011. "Calvert County Traffic Volume Map 2010 – Annual Average Daily Traffic." State Highway Administration, Highway Information Services Division. Published Date 03-01-2011. http://sha.md.gov/Traffic_Volume_Maps/Calvert.pdf.

Maryland Historical Trust (MHT). 2011. "Maryland Historic Trust Approval of March 31, 2011 letter re: Initiation of Section 106 Process for the Environmental Review of Calvert Cliffs Independent Spent Fuel Storage Installation Proposed License Renewal," April 27, 2011. Accession No. ML111250081.

National Oceanic and Atmospheric Administration (NOAA), National Climatic Data Center (NCDC). 2011. http://www.ncdc.noaa.gov/oa/ncdc.html. Accessed on November 18, 2011.

National Oceanic and Atmospheric Administration – National Marine Fisheries Service (NOAA NMFS). 2011. Letter (April 15) from M. Colligan (NOAA) to D. Diaz-Toro (NRC). ADAMS Accession No. ML111170526.

National Park Service, 2010. "Access, Stewardship and Interpretive Opportunity Plan for Water Portions of the Star-Spangled Banner National Historic Trail in Maryland." October 15, 2010. http://www.nps.gov/ stsp/upload/Water-Trail-Plan-FINAL.pdf. 2010.

———. "Star-Spangled Banner National Historic Trail." http://www.nps.gov/stsp/index.htm. Accessed on November 14, 2011. 2011.

Naval Air Station Patuxent River, 2011a. "RE: Request for meteorological information for the Naval Air Station Patuxent River." Electronic mail (September 28) from T. Wenger (NAS Patuxent River) to J. Park (NRC). ADAMS Accession No. ML113460068.

———. ""RE: Request for meteorological information for the Naval Air Station Patuxent River." Electronic mail (October 3) from T. Wenger (NAS Patuxent River) to J. Park (NRC). ADAMS Accession No. ML113460042. 2011b.

Pennsylvania Department of Conservation and Natural Resources, 2003. "Earthquake Hazard in Pennsylvania." Bureau of Topographic and Geological Survey. Educational Series 10. Fourth Printing, June 2007. <http://www.dcnr.state.pa.us/topogeo/hazards/es10.pdf>.

Southern Maryland Online, 2011. http://somd.com/Detailed/2325.php. Accessed on November 18, 2011.

Tetra Tech NUS (Tetra Tech). 2007. *Final Faunal Survey Report for Proposed UniStar Nuclear Project Area, Calvert Cliffs Nuclear Power Plant Site, Calvert County, Maryland*. Germantown, Maryland. Accession No. ML090690114.

Tidal Sediment Task Force, 2005. "Sediment In The Chesapeake Bay And Management Issues: Tidal Erosion Processes," Sediment Workshop of the Chesapeake Bay Program, Nutrient Subcommittee. < http://www.mgs.md.gov/coastal/pub/tidalerosionChesBay.pdf > May 2005.

UniStar Nuclear Energy (UniStar). 2009a. "Calvert Cliffs Nuclear Power Plant Unit 3 Combined License Application, Part 2, Final Safety Analysis Report." Revision 6. Baltimore, Maryland. ADAMS Accession No. ML092880866. September 2009.

———. "Calvert Cliffs Nuclear Power Plant Unit 3 Combined License Application, Part 3, Environmental Report." Revision 6. Baltimore, Maryland. September 30, 2009. ADAMS Accession No. ML092880921. 2009b.

———. "Response to Request for Additional Information for the Calvert Cliffs Nuclear Power Plant, Unit 3, RAI No. 322, Vibratory Ground Motion." Letter (October 28) to Document Control Desk (NRC). ADAMS Accession No. ML11305A130. 2011.

U.S. Census Bureau (USCB). 2010. http://www.census.gov.

U.S. Department of Agriculture (USDA) Economic Research Service (ERS). 2011. http://www.ers.usda.gov.

U.S. Department of Energy (DOE) Office of Civilian Radioactive Waste Management. 2008. *Americans' Average Radiation Exposure*. http://www.ocrwm.doe.gov/factsheets/doeymp0337.shtml.

———. "Dominion Cove Point LNG, LP - FE Dkt. 11-128-LNG (NFTA)." http://www.fossil.energy.gov/programs/gasregulation/authorizations/2011_applications/Dominion_Cove_Point_LNG,_LP_11-128-LNG.html. Accessed on April 30, 2012. 2012.

U.S. Fish and Wildlife Service (USFWS), 2011. "Proposed 40 year license renewal for Calvert Cliffs Independent spent fuel storage Installation (ISFI)." Chesapeake Bay Field Office Letter (October 3) to D. Diaz-Toro (NRC). ADAMS Accession No. ML112930072.

U.S. Geological Survey, 2011. Earthquake Hazards Program. http://earthquake.usgs.gov/earthquakes/eqinthenews/2011/se082311a/. Accessed on November 17, 2011.

U.S. Nuclear Regulatory Commission (NRC), 1991. "Environmental Assessment Related to Construction and Operation of the Calvert Cliffs Independent Spent Fuel Storage Installation." ADAMS Accession No. ML022550053. March 1991.

———. “Liquefied Natural Gas Hazards Analysis – Calvert Cliffs Nuclear Power Plant, Unit Nos. 1 and 2, and the Independent Spent Fuel Storage Installation.” Letter (August 31) to R. Ochs (Maryland Safe Energy Coalition). Legacy ADAMS Accession No. 9509060045. 1995.

———. NUREG-1437, Supplement 1, “Generic Environmental Impact Statement for License Renewal of Nuclear Plants, Calvert Cliffs Nuclear Power Plant.” Washington, D.C. U.S. Nuclear Regulatory Commission. October 1999.

———. “Issuance of Renewed Facility Operating Licenses, Nos. DPR-53 and DPR-69, Calvert Cliffs Nuclear Power Plant Units 1 and 2.” Letter (March 23) to C. Cruse, Baltimore Gas and Electric Company. ADAMS Accession No. ML003694857. 2000.

———. “Environmental Review Guidance for Licensing Actions Associated with NMSS Programs – Final Report.” NUREG-1748. Washington, D.C. U.S. Nuclear Regulatory Commission. August 2003.

———. “Notice of Finding of No Significant Impact of the Calvert Cliffs Independent Spent Fuel Storage Installation (ISFSI) Request for Proposed License Amendment.” Letter (May 11) to G. Vanderheyden (CCNPP). ADAMS Accession No. ML051320128. 2005a.

———. “Amendment 6 to Material License No. SNM-2505 for the Calvert Cliffs Independent Spent Fuel Storage Installation.” Letter (June 10) to G. Vanderheyden (CCNPP). ADAMS Accession No. ML051010305. 2005b.

———. “Acceptance Review of Renewal Application to Special Nuclear Materials License No. 2505 for the Calvert Cliffs Site Specific Independent Spent Fuel Storage Installation (Tac No. L24475).” Letter (March 11) to G. Gellrich, CCNPP. ADAMS Accession No. ML110730101. 2011a.

———. “Request for Information Regarding the Environmental Review of the Proposed 40-Year License Renewal for Calvert Cliffs Independent Spent Fuel Storage Installation.” Letter (March 31) to R. Summers (Maryland Department of Environment). ADAMS Accession No. ML110560787. 2011b.

———. “Request for Information for the Environmental Review of the Proposed 40-Year License Renewal for Calvert Cliffs Independent Spent Fuel Storage Installation.” Letter (March 31) to J. Griffin (Maryland Department of Natural Resources). ADAMS Accession No. ML110560647. 2011c.

———. “Initiation of Section 106 Process for the Environmental Review of Calvert Cliffs Independent Spent Fuel Storage Installation Proposed License Renewal.” Letter (March 31) to J. R. Little (Maryland Historical Trust). ADAMS Accession No. ML110560720. 2011d.

———. “Preliminary Determination of No Effect Regarding Endangered or Threatened Species and Critical Habitat for the Proposed 40-Year License Renewal for Calvert Cliffs Independent Spent Fuel Storage Installation.” Letter (March 31) to L. Miranda (U.S. Fish and Wildlife Service). ADAMS Accession No. ML110560670 . 2011e.

———. “Preliminary Determination of No Effect Regarding Endangered or Threatened Species and Critical Habitat for the Proposed 40-Year License Renewal for Calvert Cliffs Independent Spent Fuel Storage Installation.” Letter (March 31) to P. Robertson (National Oceanic and Atmospheric Administration – National Marine Fisheries Service). ADAMS Accession No. ML110670385. 2011f.

———. “Initiation of Section 106 Consultation Process for the Environmental Review of the Proposed 40-Year License Renewal for Calvert Cliffs Independent Spent Fuel Storage Installation.” Letter (March 31) to the Honorable Mervin Savoy (Piscataway Conoy Confederacy and Subtribes, Inc.). ADAMS Accession No. ML110670403. 2011g.

———. “Initiation of Section 106 Consultation Process for the Environmental Review of the Proposed 40-Year License Renewal for Calvert Cliffs Independent Spent Fuel Storage Installation.” Letter (March 31) to the Honorable Natalie Proctor (Cedarville Band of Piscataway Indians, Inc). ADAMS Accession No. ML110560754. 2011h.

———. “Request for Information Regarding the Environmental Review of the Proposed 40-Year License Renewal for Calvert Cliffs Independent Spent Fuel Storage Installation” Letter (March 31) to T. Hardy (Commission on African American History and Culture). ADAMS Accession No. ML110560771. 2011i.

———. “Initiation of Section 106 Consultation Process for the Environmental Review of the Proposed 40-Year License Renewal for Calvert Cliffs Independent Spent Fuel Storage Installation.” Letter (May 5) to the Honorable William Redwing Tayac (Piscataway Indian Nation). ADAMS Accession No. ML111250187. 2011j.

———. “Environmental Impact Statement for the Combined License (COL) for Calvert Cliffs Nuclear Power Plant Unit 3 – Final Report.” NUREG-1936. Washington, D.C. U.S. Nuclear Regulatory Commission. May 2011. 2011k.

———. “Request for Comment: Draft Environmental Assessment for the Proposed Calvert Cliffs Nuclear Power Plant Independent Spent Fuel Storage Installation License Renewal.” Letter (March 27) to J. Griffin (Maryland Department of Natural Resources). ADAMS Accession No. ML120530497. 2012.

Wheeler, R. and Johnston, A. 1992. *Geologic Implications of Earthquake Source Parameters in Central and Eastern North America*, Seismological Research Letters, Volume 63, Number 4, p 491-505.

Appendix A

Cover Types and Associated Dominant Species at the Calvert Cliffs Site

Cover Type	Dominant Vegetative Species	Dominant Wildlife Species
Mixed Deciduous Forest	Virginia Pine (*Pinus virginiana*) Tulip Poplar (*Liriodendron tulifera*) Chestnut Oak (*Quercus prinus*) White Oak (*Quercus alba*) Black Oak (*Quercus velutina* Southern Red Oak (*Quercus falcate*) Scarlet oak (*Quercus coccinia*) American Beech (*Fagus grandifolia*) Pignut Hickory (*Carya glabra*) Bitternut Hickory (*Carya cordiformis*) Red Maple (*Acer rubrum*) Sweet Gum (*Liquidambar syraciflua*) Swamp Chestnut Oak (*Quercus michauxii*) Black Gum (*Nyssa sylvatica*) Mountain Laurel (*Kalmia latifolia*) Pawpaw (*Asimina trilobata*) American Holly (*Ilex opaca*) Partridgeberry (*Mitchella repens*) Christmas Fern (*Polystichum acrostichoides*) Common Violet (*Viola papilionacea*) Large Whorled pogonia (*Isotria verticillata*)	Eastern Gray Squirrel (*Sqiurus carolinensis*) Fox Squirrel (*Sqiurus niger*) Eastern Chipmunk (*Tamias striatus*) Gray Fox (*Urocyon cinereoargenteus*) Bobcat (*Lynx rufus*) Great-horned Owl (*Bubo virginianus*) Red-shouldered Hawk (*Buteo lineatus*) Northern Cardinal (*Cardinalis cardinalis*) Yellow-billed cuckoo (*Cocoyzus americanus*) Eastern Wood-Pewee (*Contopus virens*) Pileated Woodpecker (*Dryocopus pileatus*) Blue Jay (*Cyanocitta cristata*)
Old Field	Common Reed (*Phyragmites australis*) Blackberry (*Rubus allegheniensis*) Tall Fescue (*Festuca arundinacea*) Sericea Lespedeza (*Lespedeza cuneata*) Canada Goldenrod (*Solidago Canadensis*) Asters (*Aster* spp.)	Woodchuck (*Marmota monax*) Bobwhite Quail (*Colinus virginianus*) American goldfinch (*Carduelis tristis*) Turkey Vulture (*Cathartes aura*) Gray Catbird (*Dumetella carolinensis*) Northern Black Racer (*Coluber constrictor*)
Landscaping and Development	Lawn Grasses Broadleaf Weedy Species Planted Ornamental Trees and Shrubs	Killdeer (*Charadrius vociferous*) American robin (*Turdus migratorius*) Ruby-throated hummingbird (*Archilochus colubris*)
Mixed Deciduous Regeneration Forest	Virginia Pine (*Pinus virginiana*) Tulip Poplar (*Liriodendron tulifera*) Oak Species Sweet Gum (*Liquidambar syraciflua*) Red Maple (*Acer rubrum*) Mountain Laurel (*Kalmia latifolia*) American Holly (*Ilex opaca*)	Tufted Titmouse (*Baeolophus bicolor*) White-tailed Deer (*Odocileus virginianus*) Eastern Cottontail Rabbit (*Sylvilagus floridanus*) Eastern Wild Turkey (*Meleagris gallopavo*)

Cover Type	Dominant Vegetative Species	Dominant Wildlife Species
Well-drained Bottomland Deciduous Forest	Tulip Poplar (*Liriodendron tulifera*) American Beech (*Fagus grandifolia*) Sweet Gum (*Liquidambar syraciflua*) Black Gum (*Nyssa sylvatica*) Red Maple (*Acer rubrum*) Mountain Laurel (*Kalmia latifolia*) American Holly (*Ilex opaca*) New York Fern (*Thelypteris noveboracensis*)	Racoon (*Procyon lotor*) Beaver (*Castor canadensis*) Red-winged Blackbird (*Agelaius phoeniceus*) Great Blue Heron (*Ardea herodias*) Canada Goose (*Branta candensis*) Copperhead (*Agkistrodon contortrix*) Spring Peeper (*Hyla crucifer*)
Poorly-drained Bottomland Deciduous Forest	Red Maple (*Acer rubrum*) Sweet Gum (*Liquidambar syraciflua*) Black Gum (*Nyssa sylvatica*) New York Fern (*Thelypteris noveboracensis*) Sensitive Fern (*Onoclea sensibilis*) Royal Fern (*Osmunda regalis*) Tussock Sedge (*Carex stricta*) Eastern Bur-reed (*Sparangium americanum*) Soft Rush (*Juncus effuses*) Lizard Tail (*Saururus cernuus*) Skunk Cabbage (*Symplocarpus foetidus*)	Racoon (*Procyon lotor*) Beaver (*Castor canadensis*) Red-winged Blackbird (*Agelaius phoeniceus*) Great Blue Heron (*Ardea herodias*) Canada Goose (*Branta candensis*) Copperhead (*Agkistrodon contortrix*) Spring Peeper (*Hyla crucifer*)
Herbaceous Marsh	Reeds (*Phragmites* spp.) Sedges (*Carex* spp.) Rushes (*Juncus* spp.) Lizard tail (*Saururus cernuus*) Dotted Smartweed (*Polygonum punctatum*) Pennsylvania smartweed (*Polygonum pensylvanicum*) Jewelweed (*Impatiens capensis*) Halberd-leaved Tearthumb (*Polygonum arifolium*)	Beaver (*Castor canadensis*) Racoon (*Procyon lotor*) Red-winged Blackbird (*Agelaius phoeniceus*) Great Blue Heron (*Ardea herodias*) Canada Goose (*Branta candensis*) Greater Yellowlegs (*Tringa melanoleuca*) Northern Water Snake (*Nerodia sipedon*) Northern Cricket Frog (*Acris crepitans*)
Successional Hardwood Forest	Black Locust (*Robinia pseudoacacia*) Black Cherry (*Prunus serotina*) Eastern Red Cedar (*Juniperus virginiana*)	Racoon (*Procyon lotor*) Beaver (*Castor canadensis*) Red-winged Blackbird (*Agelaius phoeniceus*) Great Blue Heron (*Ardea herodias*) Canada Goose (*Branta candensis*) Copperhead (*Agkistrodon contortrix*) Spring Peeper (*Hyla crucifer*)
NRC, 1999; Tetra Tech 2007		

Appendix B

Federal and State Special-Status Species in Calvert County, Maryland

Table B-1: Federal Endangered, Threatened, or Special Concern Animal and Plant Species Found in Calvert County, Maryland

Common Name	Scientific name	Federal Status
Insects		
Northeastern Beach Tiger Beetle	*Cicindela dorsalis dorsalis*	T[a]
Puritan Tiger Beetle	*Cicindela puritana*	T[a]
Plants		
Sensitive Joint-vetch	*Aeschynomene virginica*	T[a]
Fish		
Shortnose Sturgeon	*Acipenser brevirostrum*	E[b]
Atlantic Stugeon	*Acipenser oxyrinchus*	C[a]
Blueback Herring	*Alosus aestivalis*	SC[b]
Alewife	*Alosus pseudoharengus*	SC[b]
Reptiles		
Atlantic Loggerhead Turtle	*Caretta caretta*	E[b]
Green Turtle	*Cheloniamydas*	T[b]
Leatherback Turtle	*Dermochelys coriacea*	E[b]
Kemp's Ridley Turtle	*Lepdochelys kempii*	E[b]
C = Candidate; E = Endangered; SC = Species of Concern; T = Threatened		
[a]MDNR, 2010; [b]NRC, 2011k		

Table B-2: State Endangered, Threatened, or Special Concern Animal and Plant Species Found in Calvert County, Maryland

Common Name	Scientific name	State Status
Birds		
Sedge Wren	*Cistothorus plantensis*	E[a]
American Peregrine Falcon	*Falco peregrinus anatum*	I[a]
Black Rail	*Laterallus jamaicensis*	E[a]
Least Tern	*Sternula antillarum*	T[a]
Insects		
Northeastern Beach Tiger Beetle	*Cicindela dorsalis dorsalis*	E[a]
Puritan Tiger Beetle	*Cicindela puritana*	E[a]
Sable Clubtail	*Gomphus rogersi*	I[a]
Plants		
Sensitive Joint-vetch	*Aeschynomene virginica*	E[a]
Blunt-leaved Gerardia	*Agalinis obtusifolia*	E[a]

Common Name	Scientific name	State Status
Plants (continued)		
Thread-leaved Gerardia	*Agalinis setacea*	E[a]
Great Angelica	*Angelica atropurpurea*	X[a]
Single-headed Pussytoes	*Antennaria solitaria*	T[a]
Woolly Three-awn	*Aristida lanosa*	E[a]
American Barberyy	*Berberis Canadensis*	X[a]
Small-fruited Beggar-ticks	*Bidens mitis*	E[a]
Spurred butterfly pea	*Centrosema virginianum*	R[b]
Red Turtlehead	*Chelone obliqua*	T[a]
Standley's Goosefoot	*Chenopodium standleyanum*	E[a]
Linear-leaved Tick-trefoil	*Desmodium lineatum*	E[a]
Cream-flowered Tick-trefoil	*Desmodium ochroleucum*	E[a]
Few-flowered Tick-trefoil	*Desmodium pauciflorum*	E[a]
Rigid Tick-trefoil	*Desmodium rigidum*	E[a]
Shaggy Crabgrass	*Digitaria villosa*	X[a]
Glad Fern	*Diplazium pycnocarpon*	T[a]
Tobaccoweed	*Elephantopus tomentosus*	E[a]
Rough-leaved Aster	*Eurybia radula*	E[a]
Broad-leaved Beardgrass	*Gymnopogon brevifolius*	E[a]
Star duckweed	*Lemma trisulca*	E[a]
American Frog's-bit	*Limnobium spongia*	E[a]
Climbing Fern	*Lygodium palmatum*	T[a]
Angelpod	*Matelea carolinensis*	E[a]
Narrow Melicgrass	*Melica mutica*	T[a]
Creeping Cucumber	*Melothria pendula*	E[a]
Sweet Pinesap	*Monotropsis odorata*	E[a]
Evergreen Bayberry	*Morella caroliniensis*	E[a]
One-sided Pyrola	*Orthilia secunda*	X[a]
Kidneyleaf Grass-of-parnassus	*Parnassia asarifolia*	E[a]
Marsh Fleabane	*Pluchea camphorate*	E[a]
Leafy Pondweed	*Potamogenton foliosus*	E[a]
Claspingleaf Pondweed	*Potamogeton*	R[b]
Spiral Pondweed	Potamogeton spirillus	HR[b]
Shumard's Oak	*Quercus shumardii*	T[a]
Hairy Snoutbean	*Rhynchosia tomentosa*	T[a]
Engelmann's Arrowhead	*Sagittaria engelmanniana*	T[a]
Sea-purslane	*Sesuvium maritimum*	E[a]
Showy Goldenrod	*Solidago speciosa*	T[a]
Rough Rushgrass	*Sporobolus clandestinus*	T[a]
Small Rushgrass	*Sporobolus neglectus*	X[a]
Silvery Aster	*Symphyotrichum concolor*	E[a]
Southern Wild Rice	*Zizaniopsis miliacea*	E[a]

Common Name	Scientific name	State Status
Fish		
Shortnose Sturgeon	*Acipenser brevirostrum*	E[b]
Spotfin killifish	*Fundulus luciae*	R[b]
Reptiles		
Atlantic Loggerhead Turtle	*Caretta caretta*	T[b]
Green Turtle	*Cheloniamydas*	T[b]
Leatherback Turtle	*Dermochelys coriacea*	E[b]
Kemp's Ridley Turtle	*Lepdochelys kempii*	E[b]
Amphibians		
Eastern Narrow-mouthed Toad	*Gastrophryne carolinensis*	E[a]
C = Candidate; E = Endangered; HR = Highly Rare ;I = In Need of Conservation; R = Rare; SC = Species of Concern; T = Threatened; X = Endangered Extirpated		
[a]MDNR, 2010; [b]NRC, 2011k		