10.0 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION

This chapter presents the potential environmental consequences of constructing and operating a new U.S. EPR at the Calvert Cliffs Nuclear Power Plant (CCNPP) site. The environmental consequences are evaluated in five sections:

- Unavoidable adverse impacts of construction and operations
- Irreversible and irretrievable commitments of resources
- Relationship between short-term uses and long-term productivity of the human environment
- Benefit-Cost balance
- Cumulative impacts

10.1 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

This section summarizes adverse impacts of CCNPP Unit 3 construction and operation that cannot otherwise be avoided, and for which there may be no practical means of mitigation. Chapter 4 and Chapter 5 provide supporting details.

10.1.1 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS OF CONSTRUCTION

Most construction related environmental impacts can be avoided or minimized through the application of best management construction plans and conformance with applicable Federal, State and Local regulations that protect the environment. CCNPP Unit 3 requires use of a site footprint where permanent structures and roads are located. Construction activities, on the other hand, can be managed in ways that limit long-term loss of habitat and impacts to workers and the public.

Construction impacts and potential mitigation measures are discussed in Section 4.6, and summarized here in Table 10.1-1 summarizes the potential environmental impacts of construction and their mitigation. Considering the planned mitigation measures, the level of unavoidable adverse impacts from construction is expected to be SMALL.

10.1.2 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS OF OPERATIONS

Operational impacts of CCNPP Unit 3 are discussed in Chapter 5. Expected impacts and their mitigation are summarized in Table 10.1-2. Unavoidable impacts are limited to operation of the cooling water systems and the generation of additional non-radioactive and radioactive waste. Actions to minimize these impacts include use of closed-cycle cooling and waste minimization. As a result, the unavoidable adverse impacts of operation are also expected to be SMALL.

10.1.3 SUMMARY OF UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS FROM CONSTRUCTION AND OPERATIONS

Construction and operation will require the disturbance of approximately ~~420~~460 acres (~~170~~186 hectares) of land for construction, of which ~~281~~320 acres (~~114~~129 hectares) will be permanently committed to power plant structures and roads for CCNPP Unit 3. Temporary storage and lay-down areas will be restored following construction to reduce the size of the footprint affected during operations. The infrastructure required for CCNPP Unit 3 will be consistent with existing site use, with exception of the cooling tower that is being installed to limit water consumption and related ecological impacts. The use of existing offsite transmission right-of-ways for CCNPP Unit 3 will eliminate the need for construction of new corridors further limiting the plant's utilization of available land.

Protection of surface and subsurface water resources during construction will require limitations on the amount of groundwater withdrawn and the discharge of construction waste waters from dewatering activities. Best Management Practices will be implemented to limit construction related erosion and sedimentation of surface waters. Water quality monitoring will be conducted to verify that control measures are adequate. Use of groundwater during construction will be within existing appropriations and, to further limit long-term groundwater use, CCNPP Unit 3 will employ desalination technology to produce freshwater for use in the essential service water system during operations. Long-term protection of surface waters will be managed through an onsite Storm Water Pollution Prevention Plan required under current regulations.

Certain natural resources on site will be affected including unavoidable encroachment on non-tidal wetlands and surface waters. Activities within these areas will conform to applicable state and federal regulations to ensure that impacts are limited and controlled. Impacts to aquatic resources are expected to be minimal given the limited area to be committed to permanent use and the absence of threatened and/or endangered species in these freshwaters.

Construction of permanent CCNPP Unit 3 structures such as the reactor and turbine buildings and the cooling towers will require the removal of mixed deciduous forest occupying this portion of the site. Available old field will allow for reforestation efforts following construction.

There are sensitive archaeological and architectural sites located in the construction area and their protection and/or mitigation of impacts will be administered through cooperative efforts with the Maryland State Historic Preservation Officer (SHPO).

Measures to promote public health and safety will be implemented during construction and operation. The temporary increase in workforce during construction will require actions to minimize traffic congestion. A new access road and interconnection with Maryland State Highway 2/4 will facilitate traffic flow during shift change over. Noise levels at the site boundary are predicted to conform to applicable state and federal environmental standards. Non-routine noise, such as blasting, will be limited to day time. Measures to control fugitive dust and emissions from equipment will be implemented along with a general Safety and Health Plan. Emissions from the testing of diesel generators will conform to applicable Maryland state permit requirements and related federal emission standards.

Radiological dose to workers on site and to the general public have been calculated and are estimated to be well within applicable regulatory limits. Continuing monitoring of radioactivity in the environment surrounding the CCNPP site will ensure that radiological consequences of station operation are maintained within applicable environmental and health based standards. While some radioactive solid wastes will be created, efforts to control and limit their production will be implemented.

Impacts associated with the CCNPP Unit 3 cooling water systems include construction and operation of the intake and discharge structures, as well as evaporative losses from the operating cooling towers. Construction of the CCNPP Unit 3 circulating water supply system (CWS) makeup water intake structure and the ultimate heat sink (UHS) makeup intake structure will take place ~~within the existing CCNPP Unit 1 and 2 embayment behind a temporary sheet pile coffer dam~~along the shoreline terrace approximately 500 ft (152.4 m) south of the southern edge of the Units 1 and 2 intake channel curtain wall. Two intake pipes that originate at the southeastern edge of the existing Unit 1 and 2 intake channel will deliver cooling water to a common Unit 3 UHS intake and CWS intake forebay. As a result, sedimentation potentially released ~~either~~ into the CCNPP Units 1, 2 and ~~2~~3 intakes, or into the Chesapeake Bay, will be limited. Periodic maintenance dredging of the ~~combined~~ intake areas will be required for the continued operation of all three CCNPP units. These activities will conform to applicable State and U.S. Army Corps of Engineers regulations, including proper disposal of dredge spoils.

Since CCNPP Unit 3 will employ a closed-cycle cooling water system that conforms to the U.S. Environmental Protection Agency (EPA) Phase I Clean Water Act 316(b) regulations, the withdrawal of cooling water from the Chesapeake Bay will be small. The effect will be to limit impact on near shore hydrology and the potential effects of impingement and entrainment. Measures to further reduce impingement will include intake approach velocities less than 0.5 ft/sec (0.15 m/sec)~~.~~ and a CWS makeup water intake fish return system. Details of the fish return system are described in Section 3.4.

Evaporative loss from the cooling tower will not create a visible plume. Salt deposition is likely to occur but will be below NUREG-1555 (NRC, 1999) significance levels at which visible vegetation damage may occur. Offsite noise from tower operations is predicted to be within applicable state regulatory requirements.

A portion of the CWS and ESWS cooling towers water will be discharge back into the Chesapeake Bay as blowdown to maintain water quality of the cooling water as it is recirculated. The maximum blowdown water temperature rise will be approximately 12°F (6.7°C). The resulting thermal plume is predicted to be small and should not pose a threat to marine biota. The thermal discharge will contain small amounts of chemicals used in plant systems and small quantities of radioactive liquids. Concentrations of these waste water constituents will be limited by NPDES permit requirements and applicable NRC radiological release limitations.

Socioeconomic impacts of CCNPP Unit 3 construction and operation are expected to be SMALL. It is estimated that many of the skilled construction laborers will commute to the site from outside the immediate geographic area and temporary housing and other related public services appear to be adequate to absorb both the temporary increase in workers during construction and the long-term, but smaller, increase in operational staff. Beneficial increases to the local economy from taxes and spending are likely to occur but are estimated to be a small percentage of the existing economy. There are no unique minority or low-income populations within the comparative environmental impact areas surrounding the CCNPP site. Therefore, it is not likely that these groups would be disproportionately affected by construction or operation.

10.1.4 REFERENCES

(NRC, 1999). Environmental Standard Review Plan, NUREG-1555, Nuclear Regulatory Commission, October 1999.

Table 10.1-1— Construction-Related Unavoidable Adverse Environmental Impacts

(Page 1 of 5)

Impact Category	Adverse Impact	Mitigation Measures	Unavoidable Adverse Environmental Impacts
Land Use	Approximately ~~420~~460 acres (~~170~~186 hectares) of land will be disturbed of which ~~281~~320 acres (~~114~~129 hectares) will be permanently committed to power plant structures and roads for CCNPP Unit 3	Comply with applicable federal, state and local construction permits/approvals including Coastal Zone Management guidelines. Clear only areas necessary for installation of power plant infrastructure and implement construction Best Management and Storm Water Protection Plans. Limit activities in the 500 year flood plain to those associated with the intake structures. Implement a Site Resource Management Plan. Acreage will be restored/revegetated following construction to the maximum extent possible. Use of existing transmission corridor right-of-ways. Implement Storm Water Pollution Prevention Plan (SWPPP), including sediment and erosion control. Implement Spill Prevention Control and Countermeasures (SPCC) Plan. Use site Resource Management Plan and Best Management Practices (BMP) to protect resources such as wetlands and streams in vicinity; also, onsite land is not used for farmland nor is it considered prime or unique. Obtain individual U.S. Army Corps of Engineers 404 Permit; comply with BMP requirements. Obtain Maryland Non-Tidal Wetlands Protection Act permit; comply with BMP requirements.	281 acres (114 hectares) of land will be permanently occupied by nuclear plant infrastructure.

Table 10.1-1— Construction-Related Unavoidable Adverse Environmental Impacts

(Page 2 of 5)

Impact Category	Adverse Impact	Mitigation Measures	Unavoidable Adverse Environmental Impacts
Land Use (continued)	Potential to disturb archaeological and architectural sites during construction	Undertake extensive archaeological survey of site prior to construction. Review significance of sites with the Maryland State Historic Preservation Officer (SHPO) and develop plans to avoid and/or minimize impacts to these sites. Develop procedures compliant with Federal and State laws to protect cultural, historical or paleontological resources or human remains in the event of discovery during construction.	Small potential for destruction of unanticipated historic and/or cultural resources.
Hydrologic and Water Use	Construction has the potential to change drainage characteristics, flood handling, and erosion and sediment transport.	Implement BMP and Storm Water Pollution Prevention (SWPPP) Plans according to applicable Local and State regulations to limit erosion and contamination of surface waters. Comply with the U.S. Army Corps of Engineers 404 Permit.	Potential erosion of sediments into surface waters and local, temporary depression in the water table due to dewatering activities.
	Construction will require approximately 250 gpm of groundwater withdrawal.	Water use controlled within the existing CCNPP Units 1 and 2 allowable withdrawal appropriations. Monitor perched and groundwater water levels. Use offsite water supply, as needed. Following construction, use of groundwater will be replaced with water provided by a desalinization unit. Dewatering ponds will assist with groundwater recharge and sediment control.	Temporary drawdown of the aquifer and redirection of recharge source water during construction.

Table 10.1-1— Construction-Related Unavoidable Adverse Environmental Impacts
(Page 3 of 5)

Impact Category	Adverse Impact	Mitigation Measures	Unavoidable Adverse Environmental Impacts
Hydrologic and Water Use (continued)	Surface and subsurface water quality could be affected by construction activities.	Implement BMP and SWPPP. Monitor water quality in construction impoundments and compare to applicable criteria and historic data. Comply with the U.S. Army Corps of Engineers 404 Permit requirements. Use site Resource Management Plan to protect resources such as wetlands and streams in vicinity. Implement Spill Prevention, Control, and Countermeasures (SPCC) Plan.	Potential for contamination of subsurface groundwater.
Aquatic Ecology	Two onsite ponds and a small stream will be permanently affected; others will experience temporary impairment resulting in elimination and/or displacement of aquatic species	Implement BMP and SWPPP to limit erosion and sedimentation. Review CCNPP historic survey database to identify important aquatic species; conduct new surveys, as needed. Use site Resource Management Plan and BMP to protect resources.	Aquatic resources in the ponds and stream will be permanently lost.
	Chesapeake Bay marine life may be affected due to increased suspended sediment, dredging for the intake, and removal of substrate for the discharge structure.	Activities at the intake will occur within a sheet pile barrier. Dredging for the discharge will be confined to a small area and will quickly recolonize based on prior experience. Implement SWPPP, including sediment and erosion control and the construction of new impoundments, as appropriate. Comply with the U.S. Army Corps of Engineers 404 Permit requirements. Implement SPCC Plan. No marine or aquatic endangered species are expected to be impacted.	Benthic organisms in the dredged areas will be temporarily removed.

Table 10.1-1— Construction-Related Unavoidable Adverse Environmental Impacts
(Page 4 of 5)

Impact Category	Adverse Impact	Mitigation Measures	Unavoidable Adverse Environmental Impacts
Terrestrial Ecology	Vegetation loss will occur in certain construction areas, including mixed forest, old field, and wetlands habitats.	Restore available old field not impacted by CCNPP with mixed deciduous forest to provide an overall net gain and provide a suitable location to transplant the showy goldenrod from the Camp Conoy area. Perform activities in wetlands in accordance with permit requirements of Section 404 of the Clean Water Act and the Maryland Non-tidal Wetlands Protection Act including setbacks and erosion controls. Facilities will be sited to limit wetland encroachment. Review CCNPP historic survey database to identify important terrestrial species; conduct new surveys, as needed. Use site Resource Management Plan and BMP to protect resources. Preserve aesthetically outstanding tree clusters, as practical; harvest merchantable timber; use or recycle other woody material, as appropriate; develop reforestation plan. Obtain individual U.S. Army Corps of Engineers 404 Permit; comply with BMP requirements. Obtain Maryland Non-Tidal Wetlands Protection Act Permit; comply with BMP requirements. Acreage will be restored following construction to the maximum extent possible.	A limited amount of mixed deciduous forest will be lost. A portion of onsite wetlands will be lost.
Terrestrial Ecology	Designated bird species may be displaced or disturbed.	Manage forest habitat specific to key bird species to limit habitat fragmentation. Reclamation of old fields will contribute to added forest habitat. Consult with appropriate agencies regarding avoidance and appropriate mitigation measures, if necessary, for bald eagle nests. Design construction footprint to account for Chesapeake Bay Critical Area and other important habitat, including bald eagle nests. Minimize lighting, as practicable and allowed by regulation. No activities will take place in the most favorable habitat area for the two threatened beetles, thereby avoiding impact.	No unavoidable impacts.

Table 10.1-1— Construction-Related Unavoidable Adverse Environmental Impacts

(Page 5 of 5)

Impact Category	Adverse Impact	Mitigation Measures	Unavoidable Adverse Environmental Impacts
Socioeconomic	Construction workers, existing employees and local residents could be affected by increased dust, noise, emissions and traffic.	Onsite noise will be maintained within applicable Maryland limits and OSHA noise-exposure limits. Limit construction activities resulting in non-routine noise levels to day time. Train construction workers and employees in use of appropriate personal protective equipment Develop fugitive dust and vehicle emissions control strategies in conformance with air quality standards and best management practices. Ameliorated traffic congestion with improvements to site access road from Maryland State Route 2/4 and with onsite shift changes. Comply with applicable U.S. EPA and Maryland Department of the Environment (MDE) air quality regulations. Install new site perimeter and access road.	No unavoidable impacts.
	Public services supporting construction activities and expanded work force may be impacted. Influx of workers may impact housing availability.	Minor aggregate socioeconomic impacts anticipated; mitigation not required. Town Comprehensive Plans address stressors associated with population growth. There are adequate numbers of vacant housing units to accomodate the influx of workers.	Small increase in emergency calls, number of new students, temporary housing. No unavoidable adverse impacts. No unavoidable adverse impacts
Radiological	Construction workers will be exposed to small doses of radiation from existing units.	All doses will be within 10 CFR 20.1301 limits. Implement ALARA practices at construction site.	Small doses to construction workers.
Atmospheric and Meteorological	Construction will cause increased air emissions from traffic and construction equipment, and fugitive dust.	Train construction workers and employees on appropriate personal protective equipment. Develop fugitive dust and vehicle emissions control strategies in conformance with air quality standards and best management practices. Equipment maintenance plans. Comply with applicable U.S. EPA and MDE air quality regulations.	No unavoidable adverse impacts.
Environmental Justice	No disproportionate impacts to low income or minority groups were identified.	None.	No unavoidable adverse impacts.
Non-radiological Health Impacts	Risk to workers from accidents and occupational illness.	Implement construction site-wide health and safety program.	Industrial worker accidents may occur.

Table 10.1-2— Operations-Related Unavoidable Adverse Environmental Impacts

(Page 1 of 3)

Impact Category	Adverse Impact	Mitigation Measures	Unavoidable Adverse Environmental Impacts
Land Use	The CCNPP Unit 3 footprint will permanently occupy a portion of the site. Some potential impact on land and water courses from spills and discharges.	Limit area required during design and construction. Maintain Storm Water Pollution Prevention Plan (SWPPP), including sediment and erosion control. Maintain Spill Prevention Control and Countermeasures (SPCC) Plan.	Land use is consistent with current operations at the site. No unavoidable impacts
	Operation of the new unit will increase radioactive and non-radioactive waste disposal in landfills and onsite in long-term storage facilities. Transmission line maintenance may have some impact on vegetation and wildlife.	Implement a waste minimization, pollution prevention program to limit waste generation. Best management practices will mitigate potential impacts from vegetation control and other ROW activities.	Some land will be dedicated to offsite and onsite waste storage and will not be available for other uses. Unavoidable but small impacts may occur as a result of keeping the ROWs in a safe condition.
Hydrologic and Water Use	Circulating water supply system makeup water will be withdrawn from Chesapeake Bay potentially affecting near-shore hydrology.	Implement closed-cycle cooling and reduce water use.	No unavoidable impact.
	Evaporative loss of water from the cooling tower represents a consumptive use.	Use desalination to supply makeup water; minimize use of groundwater resources.	A limited amount of cooling water taken from Chesapeake Bay will be consumed through evaporative loss.
Aquatic Ecology	Cooling water withdrawal will result in impingement and entrainment.	Implement closed-cycle cooling. Limit intake velocity. Implement the use of a fish return system.	Some limited entrainment and impingement will occur.
Aquatic Ecology (continued)	Thermal plume may impact aquatic species abundance and distribution.	Meet all applicable state and federal regulatory requirements regarding the discharge of heat. The diffuser is being designed to rapidly disperse the thermal discharge.	A small thermal plume will be created.
	Biofouling and other process control chemicals will be discharged.	Meet all applicable state and federal Clean Water Act and NPDES permit regulations and limitations.	Chemicals will be discharged in small quantities.

Table 10.1-2— Operations-Related Unavoidable Adverse Environmental Impacts

(Page 2 of 3)

Impact Category	Adverse Impact	Mitigation Measures	Unavoidable Adverse Environmental Impacts
	Recreational and commercial fishing may be impacted by impingement and entrainment.	Implement closed-cycle cooling.	No unavoidable impacts.
Terrestrial Ecology	Operation of the cooling tower would result in a visible plume, fogging, icing and salt deposition.	Use of low-profile cooling tower with drift eliminators to limit evaporative loss and deposition.	The tower plumes will be visible from beyond the site boundary and from Chesapeake Bay
	Salt deposition from the cooling tower operations will have some impact on terrestrial vegetation.		No unavoidable adverse impacts.
	Bird collisions with the tower may occur.	Use of low-profile cooling tower and lower lighting	No unavoidable adverse impacts
Socioeconomic	Operating nuclear plants emit low noise.	Studies demonstrate noise levels on and offsite will meet applicable regulations.	No unavoidable adverse impacts.
	The additional transmission line has potential to cause electric shock onsite	Design to NESC code to minimize potential impacts.	No unavoidable adverse impacts.
	Cooling tower and plume may impact existing site aesthetics.	Site contours and the forest canopy limit landward visibility. The new facilities will be consistent with existing uses. The towers will have a low-profile.	The cooling tower plume will be visible from Chesapeake Bay, and inland offsite during winter.
Socioeconomic (continued)	An additional 363 permanent staff will increase traffic during shift changes.	A new access road and interconnection with Maryland State Route 2/4 will limit traffic congestion. Heavy plant components will be barged in.	No unavoidable adverse impacts.
	Air quality could potentially be affected due to onsite diesel generators.	Conform to state and federal emission standards and permit requirements.	No unavoidable adverse impacts.
	Population increases due to added staff may affect public services. Public services supporting the increased operations work force may be impacted. Increased direct and indirect work force and increased population may impact housing availability.	Existing capacity exists to absorb the increased population related services. County Comprehensive Plans address population growth, housing, land use, recreation, and public services. The number of vacant housing units will be adequate to accomodate the increased work force.	No unavoidable adverse impacts. Small increase in emergency calls, students use of recreational facilities.
Radiological	Potential doses to members of the public from releases to air and surface water.	All releases will be well below regulatory limits.	No unavoidable adverse impacts.

Table 10.1-2— Operations-Related Unavoidable Adverse Environmental Impacts

(Page 3 of 3)

Impact Category	Adverse Impact	Mitigation Measures	Unavoidable Adverse Environmental Impacts
	General public and worker exposure to radiation during incident-free transport of fuel and wastes.	Detailed analysis performed in accordance with 10 CFR 51.52(b), yielding conservative results.	No unavoidable adverse impacts.
Atmospheric and Meteorological	The cooling tower plume will traverse the site.	Use of cooling tower drift eliminators to limit drift losses.	No unavoidable adverse impacts.
Environmental Justice	No disproportionately high or adverse impacts on minority or low income populations are predicted.	None required.	No unavoidable adverse impacts.
Non-radiological Health Impacts	Potential growth of infectious organisms within the Essential Service Water System coolong towers.	Apply best management biocide treatment to limit growth and dispersal of harmful organisms.	No unavoidable adverse impacts.
	Risk to workers from occupational related accidents and illnesses.	Implement site-wide Safety and Medical Program.	Some accidents are likely to occur.

10.2 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

This section describes the expected irreversible and irretrievable environmental resource commitments used in the construction and operation of Calvert Cliffs Nuclear power Plant (CCNPP) Unit 3. The information contained in this section satisfies the requirements of 10 CFR 51.45(b)(5) (CFR, 2007) and 10 CFR 51, Appendix A to Subpart A (CFR, 2007), with respect to consideration of irreversible and irretrievable commitment of resources (CFR, 2007).

Irreversible resource commitments are those that could not be restored at a later time to pre-existing conditions. Irretrievable resources are materials that will be used that could not, by practical means, be recycled or restored for other uses.

10.2.1 IRREVESIBLE ENVIRONMENTAL COMMITTMENTS

Irreversible environmental commitments resulting from installation of CCNPP Unit 3 in addition to materials used for nuclear fuel fabrication and onsite structural components include:

- Surface water
- Land
- Aquatic and terrestrial biota, and
- Releases to air and surface water

10.2.1.1 Surface Water

Surface waters will be withdrawn from the Chesapeake Bay to support the Circulating Water Supply System (CWS) and Essential Service Water Systems (ESWS). Some of this water will be consumed as a result of evaporative loss from the cooling towers. The remainder will be returned to the Chesapeake Bay. The amount of water potentially lost from the CWS cooling tower due to evaporation is expected to be approximately ~~17,400~~19,016 gpm (~~65,920~~71,984 lpm). Evaporative loss from the ESWS cooling tower will be approximately ~~940~~566 gpm (~~3,560~~2,142 Lpm) during operation. Because evaporative loss is consumptive, it will be unavailable for other uses.

The onsite water courses and non-tidal wetlands that will be filled or otherwise modified to accommodate the construction of CCNPP Unit 3 represent a small percent of the existing areas occupied by these natural resources. While the overall percent of area to be affected is small, those areas included within the CCNPP Unit 3 footprint will be permanently unavailable for reclamation in the future.

The groundwater limits currently permitted for CCNPP Units 1 and 2 will be adhered to in meeting water demands during construction of CCNPP Unit 3. Groundwater withdrawals will not be needed to support operation of CCNPP Unit 3. Groundwater that is removed from the aquifer to support construction will be consumed or managed as surface water run off. The impact to this resource will be temporary and SMALL. Because the resource use is consumptive, it will not be available for other uses.

10.2.1.2 Land Use

Land designated for the storage of radioactive and non-radioactive waste on and offsite is dedicated to that use and will be unavailable for other uses during the operational period.

Following decommissioning and the development of permanent offsite storage, the onsite waste storage areas could be reclaimed.

10.2.1.3 Aquatic and Terrestrial Biota

Construction of CCNPP Unit 3 will require the removal of a portion of the onsite mixed deciduous forest and will encroach on landward surface waters and wetlands. These areas will be permanently occupied by plant structures during operations and will be unavailable for reclamation. However, the construction areas represent a small percentage of the overall site acreage and do not contain any unique or otherwise protected aquatic or wetland species.

10.2.1.4 Releases to Air and Surface Water

Radioactivity, air pollutants and chemicals will be released to the environment during routine operations of CCNPP Unit 3. Since these releases will conform to applicable Nuclear Regulatory Commission, U.S. Environmental Protection Agency and the State of Maryland regulations, their impact to the public health and the environment would be limited. Routine long-term monitoring of radioactivity in the environment and the measurement of chemical concentrations discharged will be performed to verify regulatory compliance.

10.2.2 IRRETRIEVABLE COMMITMENTS OF RESOURCES

Irretrievable commitments of resources during construction of CCNPP Unit 3 will be similar to that required for other major energy construction projects. Studies performed for the U.S. Department of Energy have summarized the amount of materials historically consumed for nuclear power plant construction (DOE, 2004a) (DOE, 2005).

For a typical new 1,300 MWe nuclear power plant, it can be estimated that reactor building steel-plate reinforced structures would require 12,239 yards of concrete and 3,107 tons of rebar. Approximately 2,500,000 linear feet of cable would be required for the reactor building, and 6,500,000 linear feet of cable and up to 275,000 feet of piping for the unit. Based on historical information from operating reactors (DOE, 2005), it is estimated that pressurized water reactors between 1,000 and 1,300 MWe require a total of approximately 182,900 cubic yards of concrete to construct the reactor building, major auxiliary buildings, turbine generator building and the turbine generator pedestal. A total of 20,512 tons of structural steel was typically required.

The rated electrical output for CCNPP Unit 3 is 1,710 MWe. This is approximately 30% higher than the largest plant referenced in the historical data. However, these historical estimates are representative of the quantities of materials that will be consumed during construction. Historical data for materials consumed for domestic nuclear power plant construction in the 1970's is summarized in Table 10.2-1 (DOE, 2005).

The inventories of construction materials tabulated by the US Census Bureau for 2002, 2005, and 2006 are shown in Table 10.2-2. In general, construction supplies increased from 2002 through 2006 suggesting that such commodities will continue to be available for the foreseeable future in response to demand (USCB, 2006a).

Similarly, inventories of minerals and related construction materials have remained relatively stable between 2000 and 2005 (Table 10.2-3) (USCB, 2008). Another important measure is industry capacity in those sectors that may affect nuclear power plant construction. In general, the data suggest that most industries have surplus capacity (Table 10.2-4). During the fourth quarter of 2007, U.S. domestic manufacturing plants collectively used only 70% of their full production capacity (USCB, 2006).

While these quantities are large, their use provides a cost-effective allocation of resources given that energy from nuclear power plants is now increasingly cost competitive (DOE, 2004a) (DOE, 2005). Furthermore, nuclear energy provides environmental benefits consistent with current concerns relative to overall life cycle environmental effects caused by fuel extraction, emission of air pollutants and solid waste disposal typically associated with fossil fuel (DOE, 2004b) (WNA, 2005).

Irretrievable resources include uranium and the energy used to fabricate fuel. However, available supplies of uranium suggest that there is a considerable degree of security of supply to ensure the continued operation and expansion of nuclear power for the foreseeable future (NEA, 2002) (WNA, 2006).

While a given quantity of material consumed during construction and operation of CCNPP Unit 3 will be irretrievable, except for materials recycled during decommissioning, the impact on their availability is expected to be SMALL.

10.2.3 REFERENCES

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Table 10.2-1— Summary of Historical Data – Materials Consumed by Nuclear Power Plant Construction in the United States During the 1970's

	BWR 1074-1308 MWE	PWR 1116-1311 MWE	LWR 1074-1311 MWE
Building Volume			
Building Volume 1,000,000 cubic ft (1,000,000 cubic m)	14.6 (0.41)	15.9 (0.45)	15.3 (0.43)
Concrete (Reactor Building, Major Auxiliary Buildings, Turbine Generator Building, Turbine Generator Pedestal, Other)			
Concrete 1,000 cubic yds (1,000 cubic m)	195.7 (149.6)	182.9 (139.8)	188.7 (144.3)
Concrete cubic yds/net KW (cubic m/net KW)	173.2 (132.4)	152.8 (116.8)	162.1 (123.9)
Concrete cubic yds/building 1,000 ft (cubic m/building cubic 1,000 ~~ft~~m)	12.5 (~~9.6~~338)	11.3 (~~8.6~~305)	11.8 (~~9.0~~319)
Structural Steel (supports, shield plate, miscellaneous steel)			
Structural Steel Tons (MT)	13,642 (12,376)	20,512 (18,608)	17,389 (15,775)
Structural Steel lb/net KW (kg/net KW)	23.9 (10.8)	34.1 (15.5)	29.5 (13.4)
Structural Steel TN/building 1,000 cubic ft (MT/building 1,000 cubic m	0.94 (~~.024~~30.32)	1.30 (~~0.033~~41.93)	1.13 (~~0.029~~36.45)

BWR – Boiling water reactor
PWR – Pressurized water reactor
LWR – Light water reactor

Table 10.2-2—Estimated Inventories of Construction Supplies Based on U.S. Merchant Wholesalers Data in 2002, 2005 and 2006 (USCB, 2006a)

Category	Inventories ($\$x10^6$)		
	2002	2005	2006
Metals and Minerals	14,750	23,782	29,567
Electrical Goods	28,188	32,098	35,747
Hardware, Plumbing, Heating equipment and supplies	12,855	15,385	16635
Machinery, Equipment, and Supplies	53,495	65,237	70,866
Lumber & Other Construction Materials	10,300	16,524	17,080

Reference: USCB, 2006a

Table 10.2-3—U.S. Mineral Production in 2000, 2005 and Estimated for 2006 (USCS 2008)

Category	Inventory		
	2002	2005	2006 est
Inventories Per 1000 metric tons			
Aluminum (Per 1000 metric tons)	3,688	2,481	2,280
Copper (Per 1000 metric tons)	1,450	1,140	1,200
Iron ore (mil. metric tons)	61	53	53
Lead (Per 1000 metric tons)	449	426	430
Titanium (Per 1000 metric tons)	300	300	300
Zinc (Per 1000 metric tons)	805	748	725
Portland Cement (mil. metric tons)	84	94	94
Masonry Cement (mil metric tons)	4	5	5
Construction Sand and Gravel (mil. metric tons)	1,120	1,270	1,280

Reference: USCB, 2008

Table 10.2-4—Percent Capacity Utilization Rates by Industry (USCB 2006b)

Industry	2002	2003	2004	2005	2006
Primary Metal Manufacturing	71	72	74	79	73
Ferrous Metal Foundries	62	63	68	72	72
Nonferrous Metal Foundries	65	63	60	66	64
Fabricated Metal Products	59	61	66	68	70
Electrical Equipment	60	64	69	68	69

Reference USCB, 2006b

10.3 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY OF THE HUMAN ENVIRONMENT

The CCNPP Unit 3 environmental report provides information associated with the environmental and socioeconomic impacts of activities that occur during construction and operation. These activities are considered short-term for purposes of this section and include that period through prompt decommissioning. Long-term is considered to be that period from construction to end of plant life and beyond that required for delayed decommissioning. This section reviews the extent to which the proposed project use of the environment precludes any future, long-term use of the site.

The information contained in this Section satisfies the requirements of 10 CFR 51.45(b)(4) (CFR, 2007) and 10 CFR 51, Appendix A to Subpart A (CFR, 2007), with respect to consideration of irreversible and irretrievable commitment of resources.

10.3.1 CONSTRUCTION AND LONG-TERM PRODUCTIVITY

Section 10.1 summarizes the potential unavoidable adverse environmental impacts of CCNPP Unit 3 construction including measures being implemented to mitigate those impacts. While some impacts will remain following construction, none should preclude the future use of the site following decommissioning.

CCNPP Unit 3 is being constructed on the existing nuclear power plant site for CCNPP Units 1 and 2. As a result, construction related activities and permanent structures will be consistent with established site use. Construction activities will occupy a footprint larger than the permanent structures required for operations because of the need for additional temporary work force parking, equipment and material lay-down areas and construction buildings.

The acreage to be disturbed includes existing mixed deciduous forest and a small portion of the site's existing surface waters and non-tidal wetlands. Current plans call for reclaiming those areas affected by construction including use of old field onsite for supplemental forest plantings. These mitigation measures will limit terrestrial impacts and protect long-term productivity.

Groundwater and surface waters will be temporarily disturbed during construction due to water withdrawal and creation of dewatering basins. Following completion of construction these impacts will cease and groundwater should recharge to pre-construction levels with no long-term loss of surface or subsurface water resources.

Potential archaeological and architectural sites located in the construction area will be managed in cooperation with the Maryland State Office of Historic Preservation so that appropriate mitigative actions are implemented.

Construction of the CCNPP Unit 3 intake and discharge structures will require some disturbance of sediments within the intake embayment and in the area of the proposed discharge multi-port diffuser. Existing ecological studies performed for CCNPP Units 1 and 2 show that these impacts are temporary and will not affect long-term ecological productivity of the Chesapeake Bay in the Calvert Cliffs area.

Noise above ambient levels will occur onsite due to some construction activities. However, at the site boundary, construction related noise is expected to conform to applicable state and federal environmental standards. Non-routine noise, such as blasting, will be limited to day time. Since construction noise is temporary, there would be not long-term impacts.

Temporary traffic increases will occur due to the numbers of additional workers required to support construction. A new site access road is proposed to alleviate onsite and offsite traffic during this period and through operations and decommissioning with no long-term impact.

Economic benefits during construction accrue from the need for temporary housing and local spending. It is predicted that while this benefit is substantial, it will represent a small increment to the total economic base of the CCNPP site two-county area.

10.3.2 OPERATION AND LONG-TERM PRODUCTIVITY

The potential unavoidable adverse environmental impacts of CCNPP Unit 3 operation are also summarized in Section 10.1 along with proposed mitigation measures. Some impacts will occur during CCNPP Unit 3 operations but will largely terminate upon plant shut down and any residual environmental issues resolved during decommissioning such that long-term uses of the site are not precluded.

Environmental impacts during operations are largely related to operation of the CWS system and ESWS and the generation of radioactive wastes. Impacts of the cooling water systems stem from withdrawal of water from the Chesapeake Bay via the intake structures, evaporative loss from the systems' cooling towers and the return of cooling water back to the Chesapeake Bay.

The use of closed-cycle cooling systems will substantially reduce these potential impacts such that during and following operations there would be no long-term loss of ecological productivity of marine resources in the Chesapeake Bay. The long-term reproductive viability of marine species potentially affected by entrainment or impingement is expected to be unaffected, resulting in no long-term power plant related loss in biomass.

Discharge of the thermal plume and associated power plant chemical additives will meet applicable permit regulatory requirements during operations and are not expected to have any long-term consequences for water quality in the Chesapeake Bay. Due to the use of closed-cycle cooling, the thermal plume is predicted to occupy a comparatively small area. Similarly the concentrations of chemicals released will be limited and will quickly dissociate in marine waters with little or no long-term accumulation.

Evaporative loss of water from the cooling towers represents a consumptive use during operations but will cease following plant shutdown. Salt deposition during cooling tower operations is not predicted to cause visible vegetative impacts, yet this potential impact will also cease following shutdown as well. It is expected that terrestrial plants and/or soil will quickly recover should impacts be observed.

Emission of fossil fuel combustion byproducts will increase during the periodic testing of the CCNPP Unit 3 engines . The amount of emissions will be governed by applicable state permits and federal standards for air pollutants. Since the emissions are periodic and transient, and will cease following CCNPP Unit 3 shutdown, long term impacts to air quality are not expected.

Radiological releases will be controlled according to applicable state and federal standards to ensure protection of terrestrial and marine biota, and protection of workers and the general public. Onsite storage of radioactive wastes will be temporary and ultimately removed from site. Reclamation of the site including removal of any radioactive contamination will occur such that future long-term uses of the site are not precluded.

Socioeconomic benefits to the counties surrounding the CCNPP site will result from increased taxes, additional spending and housing. While the relative impact to the economic base is small, some benefit will continue up to and through decommissioning, particularly where increased tax revenues have been used to enhance public infrastructure and services.

10.3.3 SUMMARY OF RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

The construction and operation of CCNPP Unit 3 will result in some limited short-term and unavoidable impacts to the environment. Mitigation measures have been proposed to limit both the short-term impacts of construction and those that may occur during the operational life of Unit 3. Benefits accrue from the production of electricity and increases in the tax base that could support public infrastructure and services. Following site decommissioning, it is expected there will be no long-term impacts on productivity or the human environment that would preclude alternative uses of the site.

10.3.4 REFERENCES

CFR, 2007. Title 10, Code of Federal Regulations, Part 51, Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions, 2007.

10.4 BENEFIT-COST BALANCE

This section describes the benefit-cost balance resulting from the proposed construction and operation of Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3. It was prepared in accordance with the guidance provided in NUREG-1555 (NRC, 1999) i.e., "Environmental Standard Review Plan" (ESRP). Section 10.4.1 describes the benefits of the proposed project; Section 10.4.2 discusses the costs associated with the proposed project; and Section 10.4.3 provides a benefit-cost balance summary.

The information contained in this Section satisfies the requirements of 10 CFR 51.45(d) (NRC, 2007) and 10 CFR 51, Appendix A to Subpart A (CFR, 2007), with respect to consideration of irreversible and irretrievable commitment of resources.

10.4.1 BENEFITS

This section discusses the benefits resulting from the proposed construction and operation of CCNPP Unit 3. The information provided in this section was prepared in accordance with the guidance provided in NUREG-1555, ESRP 10.4.1 (NRC, 1999). Information provided in this section includes a summary of the following information:

- The evaluation that was performed to determine if there is sufficient demand for new electric power in Maryland;
- The evaluation that was performed to determine an electric power generation source (i.e., coal, gas, nuclear, solar, wind);
- The evaluation that was performed to choose a location for the selected electric power generation source; and
- Benefits that the new electric power generation facility will provide.

Table 10.4-1 summarizes the benefits and costs of the proposed action. Section 10.5 summarizes the potential cumulative adverse environmental impacts at the site. These benefits and costs include:

- Identification of appropriate plant production benefits;
- Calculation of the plant average annual electrical-energy generation in kilowatt-hours (kWh);
- Evaluation of the reliability of the electrical distribution system;
- Identification of other project benefits, including state and local tax revenues, regional productivity, enhancement of recreational and aesthetic values, environmental enhancement, creation and improvement of local roads or other facilities, and intangible benefits (e.g., reduced dependence on scarce fossil fuels);
- Quantification of benefits in monetary or other appropriate terms;
- Evaluation of the significance of the benefits on a political boundary or regional basis; and

- Assessment of any potential social or economic impacts as a result of the proposed project construction and operation

The potential cumulative adverse impacts at the site resulting from construction of a new power plant are summarized in Section 10.5

10.4.1.1 Need for Power

As discussed in Section 8.4, the Maryland Public Service Commission (PSC) noted in its adequacy supply report that the need for in-state generating capacity is increasing rapidly. The PSC assessed the following factors for its growing concern about reliability and power supply: Maryland's growing reliance on imported electricity and the need for infrastructure additions and new transmission.

Maryland's dependence on out-of-state generation resources will likely increase over the next 5 to 10 years because of both growth in electricity demand, and the possible de-rating or retirement of existing generating units. Further contributors to the uncertain outlook for supply adequacy is that over the next 10 years only a small amount of new electricity generation will likely be built in Maryland. The conclusion that there is a need for new baseload generating capacity in Maryland based on the following:

- Maryland has a well-defined, systematic, and comprehensive resource monitoring, assessment, and reporting process that adequately reviews the state's resources and growing demand for additional baseload, eliminating the need for additional Nuclear Regulatory Commission (NRC) review; and

- The PSC/ Power Plant Research Program (PPRP)/ Certificate of Public Convenience and Necessity (CPCN) process in Maryland assures the NRC that construction would not proceed without Maryland's due consideration of the projects impact on the adequacy, stability, and reliability of the electrical system in the state; and

- The PSC has concluded that there is a need for new baseload capacity, and this conclusion has been given "great weight" in this ER, as allowed by NUREG-1555 (NRC, 1999).

10.4.1.2 Energy Alternatives

The following paragraphs provide a summary of the evaluation that was conducted in Section 9.2, to determine a suitable electric generating power source to meet the demand for new power in Maryland. The evaluation identified alternatives that would require the construction of new generating capacity—such as wind, geothermal, oil, natural gas, hydropower, municipal solid wastes (MSW), coal, photovoltaic (PV) cells, solar power, wood waste/biomass, and energy crops, as well as any combination of these alternatives. In addition, alternatives that would not require new generating capacity were evaluated, including initiating energy conservation measures and Demand-Side Management (DSM), reactivating or extending the service life of existing plants within the power system, and purchasing electric power from other sources.

The evaluation indicated that neither a coal-fired nor a gas-fired facility would appreciably reduce overall environmental impacts relative to a new nuclear plant, with the exception of air-quality impacts. ~~Furthermore, a~~A coal-fired ~~and a~~ or gas-fired facility would entail a significantly greater environmental impact on air quality than would a new nuclear plant. The analysis indicated that wind and solar facilities in combination with fossil facilities could be used to generate baseload power. However, wind and solar facilities in combination with fossil facilities would have higher costs and larger land requirements than a new nuclear facility and therefore are not preferable to a new nuclear facility.

Based on environmental impacts, it has been concluded that neither a coal-fired, nor a gas-fired, nor a combination of alternatives, including wind and solar facilities, would appreciably reduce overall environmental impacts relative to a new nuclear plant; therefore making nuclear power a suitable electric power generation source.

10.4.1.3 Alternative Locations for the Proposed Facility

The following paragraphs provide a summary of the evaluation that was conducted in Section 9.3 to identify a preferred location for the new nuclear power facility. The objective of the evaluation was to verify that no obviously superior location for the siting of a new nuclear unit exists.

Two alternative nuclear sites were chosen for the analysis: 1) Nine Mile Point Nuclear Plant, Oswego County, Scriba, New York; and 2) R.E. Ginna Nuclear Power Plant, Wayne County, Ontario, New York. The analysis also evaluated a brownfield site located at the Crane Generating Station on the Chesapeake Bay in Baltimore County, Maryland. These sites were chosen because they are owned by Constellation and they are in relatively close proximity to the CCNPP site. In addition, a preliminary evaluation was done on a generic undeveloped greenfield site. The sites were evaluated based on potential impacts to land use, air quality water, terrestrial ecology and sensitive species, aquatic ecology and sensitive species, demographics, and historic, cultural, and archeological resources.

The evaluation concluded that the preferred location for the new nuclear facility is collocation with an existing nuclear facility. Siting a new reactor at an existing nuclear facility offers a number of benefits:

- By collocating nuclear reactors, the total number of generating sites is reduced.
- No additional land acquisitions are necessary, and the applicant can readily obtain control of the property. This reduces both initial costs to the applicant and the degree of impact to the surrounding anthropogenic and ecological communities.
- Site characteristics, including geologic/seismic suitability, are already known, and the site has already undergone substantial review through the National Environmental Policy Act (NEPA) process during the original selection procedure.
- The environmental impacts of both construction and operation of the existing unit are known. It can be expected that the impacts of a new unit should be comparable to those of the operating nuclear plant.
- Collocated sites can share existing infrastructure, reducing both development costs and environmental impacts associated with construction of new access roads, waste disposal areas, and other important supporting facilities and structures. Construction of new transmission corridors may be eliminated or reduced because of the potential use of existing corridors.
- Existing nuclear plants have nearby markets, the support of the local community, and the availability of experienced personnel.

The analysis concluded that the greenfield site could be dismissed from further evaluation based on high costs and potential adverse environmental impacts. Development of the brownfield site would offer no advantages and would increase both the cost of the new facility and the severity of impacts. Development of either of the two alternative nuclear sites offers no environmental advantages over locating the new nuclear facility at the existing CCNPP site.

10.4.1.4 Benefits of the Proposed Facility

Locating the proposed new nuclear facility at the existing CCNPP property will afford benefits to the local economy. The CCNPP owners will pay property taxes on the proposed new unit for the duration of the operating licenses. CCNPP owners estimate that annual property tax payments could reach approximately [ ] million in 2015, the year of plant startup and a maximum of [ ] million as described in Section 4.4.2.6.2. Most people consider large tax payments a benefit to the taxing entity because they support the development of infrastructure that supports further economic development and growth.

Approximately 833 people are employed at the existing CCNPP facility (BGE, 1998). It is anticipated that construction and operation of the new facility would require a skilled workforce of 363 people. New jobs within approximately a 50 mi (80 km) radius of the plant would be created by the construction and operation of the new facility. Many of these jobs would be in the service sector and could be filled by unemployed local residents, lessening demands on social service agencies in addition to strengthening the economy. It is anticipated that the new jobs would be maintained throughout the life of the plant.

Construction and operation of the new nuclear facility at CCNPP would generate an economic multiplier effect in the area. The economic multiplier effect means that for every dollar spent an additional $0.69 of indirect economic revenue would be generated within the region of influence (BEA, 2007). The economic multiplier effect is one way of measuring direct and secondary effects. Direct effects reflect expenditures for goods, services, and labor, while secondary effects include subsequent spending in the community. The economic multiplier effect due to the increased spending by the direct and indirect labor force created as a result of the construction and operation of the new nuclear reactor unit would increase economic activity in the region, most noticeably in Calvert County.

Given concerns in the State of Maryland about climate change and carbon emissions, CCNPP Unit 3 serves an important environmental benefit need by reducing carbon emissions in the State. Upon operation, CCNPP Unit 3 would displace significant amounts of carbon compared to a coal-fired generating plant. The costs of climate change, which have been quantified, will have a significant impact on the global and national economies.

10.4.2 COSTS

This section summarizes estimated costs for construction and operation of CCNPP Unit 3. The information provided in this section was prepared in accordance with the guidance provided in NUREG-1555 (NRC, 1999), ESRP 10.4.2). The discussion below provides sufficient economic information to assess and predict costs and benefits.

Table 10.4-1 summarizes the benefits and costs of the proposed action. Section 10.5 summarizes the potential cumulative adverse environmental impacts at the proposed project site.

10.4.2.1 Monetary - Construction

The phrase commonly used to describe the monetary cost of constructing a nuclear plant is "overnight capital cost." The capital costs are those incurred during construction, when the actual outlays for equipment and construction and engineering are expended, in other words, the cost resulting if one were to pay for 100% of the plant "overnight". Overnight costs are:

- expressed as a constant dollar amount versus actual nominal dollars,
- expressed in $/kW, and
- for the nuclear industry, the overnight capital cost does not include inflation, financing, extraordinary site costs, licensing, transmission or the initial fuel load.

The overnight capital cost for CCNPP Unit 3 is estimated to be [ ]. This is the unlevelized capital cost for Unit 3. The levelized capital cost for the "nth" U.S. EPR will be lower than that for CCNPP Unit 3 as a result of cost savings such as document reuse, supply chain volume savings, labor and construction sequence learning curve, and reduced spare parts inventory, that can be realized by constructing multiple EPRs. Since CCNPP Unit 3 will have a net electrical output of approximately 1,600 megawatts electric (MWe), the cost of construction is estimated to be [ ].

10.4.2.2 Monetary - Operation

Operation costs for CCNPP Unit 3 are in the process of being estimated. Operation costs are frequently expressed as the levelized cost of electricity, which is the price at the busbar needed to cover operating costs and annualized capital costs. Overnight capital costs account for a third of the levelized cost, and interest costs on the overnight costs account for another 25% (UC, 2004). At this time, levelized cost estimates ranging from $31 to $46 per MWh ($0.031 to $0.046 per kWh) has been selected. Factors affecting the range include choices for discount rate, construction duration, plant life span, capacity factor, cost of debt and equity and split between debt and equity financing, depreciation time, tax rates, and premium for uncertainty.

Estimates include decommissioning but, because of the effect of discounting a cost that would occur as much as 40 years in the future, decommissioning costs have relatively little effect on the levelized cost. In addition, the Energy Policy Act of 2005 instituted a production tax credit for the first advanced reactors brought on line in the U.S. (PL, 2005) would tend to lower this estimate.

10.4.3 SUMMARY

Table 10.4-1 summarizes the benefits and costs associated with the proposed construction and operation of CCNPP Unit 3. Costs that are environmental impacts are those anticipated after proposed mitigation measures are implemented. Section 10.5 addresses the environmental costs and cumulative impacts.

10.4.4 REFERENCES

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Financial Information withhold under 10 CFR 2.390

Table 10.4-1— Benefit and Costs of the Proposed Project Summarized

(Page 1 of 9)

Cost Category	CCNPP Site	Former Thiokol Brownfield Site	Nine Mile Point Site	Ginna Site
INTERNAL COSTS				
Construction Cost	[ ] (It is anticipated that CCNPP Unit 3 will have a net electrical output of approximately 1,600 MWe. Using the value of [ ] per kW results in a CCNPP Unit 3 construction cost of approximately [ ].)	[ ] (It is anticipated that the installed reactor will be similar to CCNPP Unit 3 (net electrical output of approximately 1,600 MWe.) Using the value of [ ] per kW results in a construction cost of approximately [ ].)	[ ] (It is anticipated that the installed reactor will be similar to CCNPP Unit 3 (net electrical output of approximately 1,600 MWe. Using the value of [ ] per kW results in a construction cost of approximately [ ].)	[ ] (It is anticipated that the installed reactor will be similar to the CCNPP Unit 3 (net electrical output of approximately 1,600 MWe. Using the value of [ ] per kW results in a construction cost of approximately [ ].)
Operating Cost	\$0.031 to \$0.046 per kilowatt-hour	\$0.031 to \$0.046 per kilowatt-hour	\$0.031 to \$0.0 46 per kilowatt-hour	\$0.031 to \$0.046 per kilowatt-hour
Land	The CCNPP site is 2,070 acres (838 hectares). Co-located on the CCNPP site with CCNPP Units 1 and 2. Impact on land use is minimal compared to a new site. SMALL	Existing power plant site is 157 acres (63 hectares) Co-located with existing power plant facility. Impact on land use is minimal compared to new site. Potential wetland issues. MODERATE	900 acres (364 hectares) of available space is available at the existing NMP site for the new facility. Co-located with existing nuclear facility. Impact on land use is minimal compared to new site. SMALL	425 acres (172 hectares) of available space is available at the existing Ginna site for the new facility. Co-located with existing nuclear facility. Impact on land use is minimal compared to new site. SMALL
Labor	Add 363 direct new jobs, ~~660~~661 indirect new jobs to the benefits. SMALL	It is assumed that similar size workforce to that which is anticipated for the proposed CCNPP facility. SMALL	It is assumed that similar size work force to that which is anticipated for the proposed CCNPP facility. SMALL	It is assumed that similar size workforce to that which is anticipated for the proposed CCNPP facility. SMALL
Materials	Construction materials include: concrete, aggregate, rebar, conduit, cable, piping, building supplies, and tools. Operating material includes uranium	Construction materials include: concrete, aggregate, rebar, conduit, cable, piping, building supplies, and tools. Operating material includes uranium	Construction materials include: concrete, aggregate, rebar, conduit, cable, piping, building supplies, and tools. Operating material includes uranium	Construction materials include: concrete, aggregate, rebar, conduit, cable, piping, building supplies, and tools. Operating material includes uranium
Equipment	Typical construction equipment will include cranes, cement trucks, excavation equipment, dump truck, and graders. Equipment for the new facility would include all of the necessary components for the facility such as the reactor, turbine, cooling system, water processing/ treatment system, cooling tower, etc.	Typical construction equipment will include cranes, cement trucks, excavation equipment, dump truck, and graders. Equipment for the new facility would include all of the necessary components for the facility such as the reactor, turbine, cooling system, water processing/treatment system, cooling tower, etc.	Typical construction equipment will include cranes, cement trucks, excavation equipment, dump truck, and graders. Equipment for the new facility would include all of the necessary components for the facility such as the reactor, turbine, cooling system, water processing/treatment system, cooling tower, etc.	Typical construction equipment will include cranes, cement trucks, excavation equipment, dump truck, and graders. Equipment for the new facility would include all of the necessary components for the facility such as the reactor, turbine, cooling system, water processing/treatment system, cooling tower, etc.

Table 10.4-1— Benefit and Costs of the Proposed Project Summarized

(Page 2 of 9)

Cost Category	CCNPP Site	Former Thiokol Brownfield Site	Nine Mile Point Site	Ginna Site
Services	Support services and supplies would be needed during construction. Security, maintenance, trash removal, and/or landscaping services may be needed during operation of the facility.	Support services and supplies would be needed during construction. Security, maintenance, trash removal, and/or landscaping services may be needed during operation of the facility.	Support services and supplies would be needed during construction. Security, maintenance, trash removal, and/or landscaping services may be needed during operation of the facility.	Support services and supplies would be needed during construction. Security, maintenance, trash removal, and/or landscaping services may be needed during operation of the facility.
Water Use	Maximum Chesapeake Bay water demand equals an estimated total ~~43,480~~47,383 gpm (~~164,590~~179,365 lpm). Surface and groundwater use will be mitigated by construction of desalinization plant for cooling water systems. SMALL	Adequate surface water (Gunpowder River, Chesapeake Bay) for plant use SMALL	Groundwater not used at current facility. Adequate surface water (Lake Ontario) for plant use. SMALL	Groundwater not used at current facility. Adequate surface water (Lake Ontario, Mill and Deer Creeks) for plant use. SMALL
EXTERNAL COSTS				
Land Use	Existing CCNPP site is 2,057 acres (832 hectares) Co-located on the CCNPP site with CCNPP Units 1 and 2. Impact on land use is minimal compared to new site. SMALL	The site is much smaller than the area required for siting a nuclear plant. Both the site and the surrounding land have been designated as critical areas. Impact on land use is MODERATE given the potential wetland issues. MODERATE	This site is capable of supporting the required 345 kV transmission lines, but will require upgrades to the switchgear. However, the tie in is currently congested with limited transmission corridor space. Two existing meteorological towers and firing range would need to be relocated since they would be affected by the new facility. No barge off-loading facility is located at the site. Rail would require licensing and reinstallation. Co-located with existing nuclear facility. Impact on land use is moderate because the new reactor would be placed near existing nuclear facilities given the potential wetland issues. SMALL-MODERATE	Currently, no right of way capable of supporting the necessary 345 kV transmission lines exists. The tie in with the existing 345 kV transmission corridor would require 20 mi (6 km) of new transmission lines and right-of-way. Estimated cost of transmission lines is $3 million per mile (not including the cost of the land). An existing meteorological tower and a proposed firing range would need to be relocated since they would be affected by the new facility. No barge off-loading facility is located at the site. Rail is not routed to the site. Impact on land use is minimal because the new reactor would be placed near existing power generating facilities. SMALL-MODERATE

Table 10.4-1— Benefit and Costs of the Proposed Project Summarized
(Page 3 of 9)

Cost Category	CCNPP Site	Former Thiokol Brownfield Site	Nine Mile Point Site	Ginna Site
Air Quality	Calvert County is in attainment with all National Ambient Air Quality Standards except for ozone. Based on the design of the new reactor, siting the unit at this location would have a SMALL impact on air quality. SMALL	The existing power facility must meet all applicable federal, state, and local air quality permitting regulations. Based on the design of the new reactor, siting the unit at this location would have a SMALL impact on air quality. SMALL	NMP is not located in an area designated as a maintenance or non-attainment area for any air pollutants by the U.S. Environmental Protection Agency. Emissions are low enough at the existing NMP facilities to be exempt from any permit requirements. Based on the design of the new reactor, siting the unit at this location would have a SMALL impact on air quality. SMALL	Air quality in the Ginna region exceeds national standards for all measured parameters. There are no nearby areas designated as areas of non-attainment or maintenance. (Emissions from existing plant activities are below state and federal thresholds; therefore operations at Ginna do not require any air quality permits. Based on the design of the new reactor, siting the unit at this location would have a SMALL impact on air quality. SMALL
Terrestrial Biology	The CCNPP site is largely forested and situated among other large forested tracts. Together these tracts form one contiguous and predominantly undeveloped forested area. The Wildlife Habitat Council has certified and registered the CCNPP site as a valuable corporate wildlife habitat SMALL-MODERATE	Both the site and the surrounding land have been designated as critical areas. Although no State or Federally listed species or sensitive habitats, archeological or historical resources, or scenic views are located in the immediate vicinity of the site, the adjacent land area is predominantly wetlands and is zoned for resource conservation. MODERATE-LARGE	The predominant land cover at the NMP site is woodlands. Federal- and state-designated wetlands including shrub wetlands, bogs, emergent marshes, and forested wetlands and inactive agricultural lands also occur on the site. Flora and fauna found on or near the site are typical of disturbed areas in the coastal communities of the region. The area is part of the Atlantic Flyway, so bird numbers and species vary seasonally as birds migrate through or return to breed. SMALL-MODERATE	The Ginna site is surrounded by a variety of habitat types, such as mature woodlands, meadows, and abandoned farm fields, all typical of central and western New York. There is no State or Federally regulated wetlands at Ginna, and no federally-listed threatened or endangered terrestrial breeding species are known to occur at the site. SMALL-MODERATE
Aquatic Biology	The area of the Chesapeake Bay where CCNPP is located is in the mesohaline zone, which is characterized by moderate salinity. Mitigation/monitoring with applicable federal, state, and local permitting regulatory entities will occur during construction and operation. SMALL	Both the site and the surrounding land have been designated as critical areas. Although no State or Federally listed species or sensitive habitats, are located in the immediate vicinity of the site, the adjacent land area is predominantly wetlands and is zoned for resource conservation. MODERATE-LARGE	There are no Federally listed threatened or endangered aquatic species in the vicinity of the NMP site. No state-listed endangered aquatic species has been collected in the extensive lake sampling and impingement monitoring efforts at the NMP site or the nearby J.A. Fitzpatrick nuclear plant and Oswego Steam Station. SMALL	Although Ginna is situated on the shore of Lake Ontario, there are no aquatic species federally listed as threatened or endangered in the vicinity of the Ginna site. SMALL

Table 10.4-1— Benefit and Costs of the Proposed Project Summarized

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Cost Category	CCNPP Site	Former Thiokol Brownfield Site	Nine Mile Point Site	Ginna Site
Socioeconomic	75,000 county population $70,000 median household income SMALL	732,700 county population $74,388 median household income SMALL	123,000 county population $38,000 median household income SMALL	94,000 county population $44,000 median household income SMALL
Housing	May be short term negative impact on availability of housing units in the area during construction SMALL	May be short term negative impact on availability of housing units in the area during construction SMALL-MODERATE	May be short term negative impact on availability of housing units in the area during construction SMALL	May be short term negative impact on availability of housing units in the area during construction SMALL
Local Infrastructure	Increased traffic at beginning and end of shifts may increase traffic on highways to and from plant. Little impact on availability of services; CCNPP Unit 3 will be built and operated in a large urbanized area. SMALL	Increased traffic at beginning and end of shifts may increase traffic on highways to and from plant. Little impact on availability of services. The proposed unit will be built and operated in an urban/rural area. SMALL-MODERATE	Increased traffic at beginning and end of shifts may increase traffic on highways to and from plant. Little impact on availability of services. The proposed unit will be built and operated in a large urbanized area. SMALL	Increased traffic at beginning and end of shifts may increase traffic on highways to and from plant. Little impact on availability of services. The proposed unit will be built and operated in a large urbanized area. SMALL
Radiological Heath	Radiological exposure below limits to workers and public SMALL	Radiological exposure below limits to workers and public SMALL	Radiological exposure below limits to workers and public SMALL	Radiological exposure below limits to workers and public SMALL
Loss of resources	Loss of resources is discussed in Sections 10.1 through 10.3. It is expected that losses will be mitigated to minimize the impact of the loss. SMALL	Loss of resources is discussed in Sections 10.1 through 10.3. It is expected that losses will be mitigated to minimize the impact of the loss. SMALL	Loss of resources is discussed in Sections 10.1 through 10.3. It is expected that losses will be mitigated to minimize the impact of the loss. SMALL	Loss of resources is discussed in Sections 10.1 through 10.3. It is expected that losses will be mitigated to minimize the impact of the loss. SMALL
Measures and Controls to reduce environmental impact	Costs associated with mitigation will be small, since this unit will be built on an existing nuclear site. Existing mitigation and environmental monitoring programs will be expanded to account for the new unit. Construction and operational impacts are expected to be small. SMALL	Costs associated with mitigation will be small, since this unit will be built on an existing power plant site. Existing mitigation and environmental monitoring programs will be expanded to account for the new unit. Construction and operational impacts are expected to be small. SMALL	Costs associated with mitigation will be small, since this unit will be built on an existing nuclear site. Existing mitigation and environmental monitoring programs will be expanded to account for the new unit. Construction and operational impacts are expected to be small. SMALL	Costs associated with mitigation will be small, since this unit will be built on an existing nuclear site. Existing mitigation and environmental monitoring programs will be expanded to account for the new unit. Construction and operational impacts are expected to be small. SMALL
Electricity Generated and Generating Capacity	The EPR nuclear power generating station reactor for the CCNPP has a rated core thermal power of 4,590 MWt electrical output of greater than or equal to 1,600 MWe.	It is assumed that the electricity generated and generating capacity would be similar to that of the CCNPP.	It is assumed that the electricity generated and generating capacity would be similar to that of the CCNPP.	It is assumed that the electricity generated and generating capacity would be similar to that of the CCNPP.

Table 10.4-1— Benefit and Costs of the Proposed Project Summarized
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Cost Category	CCNPP Site	Former Thiokol Brownfield Site	Nine Mile Point Site	Ginna Site
Fuel Diversity	Nuclear provides option to natural gas. Does not have price volatility of natural gas, fuel availability issues limited.	Nuclear provides option to natural gas. Does not have price volatility of natural gas, fuel availability issues limited.	Nuclear provides option to natural gas. Does not have price volatility of natural gas, fuel availability issues limited.	Nuclear provides option to natural gas. Does not have price volatility of natural gas, fuel availability issues limited.
Licensing Certainty	Resolution of design criteria through certification; resolution of site, construction and operational issues in Combined Operating License Application (COLA); reliance on nuclear as generation.	Resolution of design criteria through certification; resolution of site, construction and operational issues in COLA; reliance on nuclear as generation.	Resolution of design criteria through certification; resolution of site, construction and operational issues in COLA; reliance on nuclear as generation.	Resolution of design criteria through certification; resolution of site, construction and operational issues in COLA; reliance on nuclear as generation.
Carbon Emissions (reduction)	Coal: (1,908,000 carbon dioxide equivalents [CO_2eq]) Natural Gas: (623,000 CO_2e) Nuclear: No carbon emissions.	It is assumed that carbon emissions reduction would be similar to the CCNPP. Nuclear: No carbon emissions.	It is assumed that carbon emissions reduction would be similar to the CCNPP. Nuclear: No carbon emissions.	It is assumed that carbon emissions reduction would be similar to the CCNPP. Nuclear: No carbon emissions.
Increased Customer Choice	Retail choice of "clean" energy source, in addition to menu of renewable sources.	Retail choice of "clean" energy source, in addition to menu of renewable sources.	Retail choice of "clean" energy source, in addition to menu of renewable sources.	Retail choice of "clean" energy source, in addition to menu of renewable sources.
Local Economy	Add a maximum of 3,950 new employees to the workforce for construction of the new facility. It is anticipated that a direct workforce of approximately 363 employees would be needed for operation. An additional 661 indirect jobs would be created during operation. Construction and operation workforce provide an economic benefit to the community.	It is assumed that a similar size work force to that which is anticipated for the CCNPP would be needed.	It is assumed that a similar size work force to that which is anticipated for the CCNPP would be needed.	It is assumed that a similar size work force to that which is anticipated for the CCNPP would be needed.
Aesthetic Values	Selection of design and cooling tower technology allows for minimal aesthetic impacts. Site contains existing nuclear power facility structures.	Selection of design and cooling tower technology allows for minimal aesthetic impacts.	Selection of design and cooling tower technology allows for minimal aesthetic impacts. Site contains existing nuclear power facility structures.	Selection of design and cooling tower technology allows for minimal aesthetic impacts. Site contains existing nuclear power facility structures.
Air Quality	Major beneficial impact in terms of avoidance of power plant emissions.	Major beneficial impact in terms of avoidance of power plant emissions.	Major beneficial impact in terms of avoidance of power plant emissions.	Major beneficial impact in terms of avoidance of power plant emissions.
Land Use	Land to be used for new unit is owned by Constellation. The land is adjacent to an existing operating nuclear power plant.	Land will need to be acquired for the proposed Thiokol site. The required land will need to be re-zoned for development of the nuclear facility.	Land to be used for new unit is owned by Constellation. The land is adjacent to an existing operating nuclear power plant.	Land to be used for new unit is owned by Constellation. The land is adjacent to an existing operating nuclear power plant.

Table 10.4-1— Benefit and Costs of the Proposed Project Summarized
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Cost Category	CCNPP Site	Former Thiokol Brownfield Site	Nine Mile Point Site	Ginna Site
State/Local Tax Payments during Construction and Operations	Construction will generate tax revenues from sources including income tax, retail sales tax on materials, supplies, and selected construction services; retail sales tax on expenditures by workers; and corporate income taxes paid by contractors. Tax revenue will be generated on an estimated [ ] in direct and indirect wages on an annual basis. During operation of the facility, local government tax revenues will accrue from property taxes and permitting and impact fees. Tax payments would occur annually over the life of the new reactor units [ ] per year.	Construction will generate tax revenues from sources including income tax, retail sales tax on materials, supplies, and selected construction services; retail sales tax on expenditures by workers; and corporate income taxes paid by contractors. Revenue on wages will be similar to that noted for CCNPP. During operation of the facility, local government tax revenues will accrue from property taxes and permitting and impact fees. Tax payments would occur annually over the life of the new reactor units. Annual expenditures during operation on material, equipment and outside services are assumed to be similar to that noted for CCNPP.	Construction will generate tax revenues from sources including income tax, retail sales tax on materials, supplies, and selected construction services; retail sales tax on expenditures by workers; and corporate income taxes paid by contractors. Revenue on wages will be similar to that noted for CCNPP. During operation of the facility, local government tax revenues will accrue from property taxes and permitting and impact fees. Tax payments would occur annually over the life of the new reactor units. Annual expenditures during operation on material, equipment and outside services are assumed to be similar to that noted for CCNPP.	Construction will generate tax revenues from sources including income tax, retail sales tax on materials, supplies, and selected construction services; retail sales tax on expenditures by workers; and corporate income taxes paid by contractors. Revenue on wages will be similar to that noted for CCNPP. During operation of the facility, local government tax revenues will accrue from property taxes and permitting and impact fees. Tax payments would occur annually over the life of the new reactor units. Annual expenditures during operation on material, equipment and outside services are assumed to be similar to that noted for CCNPP.
State/Local Tax Payments during Construction and Operations (Cont'd)	Beneficial economic impacts associated with station operation. Operations will result in annual expenditures in approximately $9 million on materials, equipment and outside services.			

Table 10.4-1— Benefit and Costs of the Proposed Project Summarized
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Cost Category	CCNPP Site	Former Thiokol Brownfield Site	Nine Mile Point Site	Ginna Site
Effects on Regional Productivity	Anticipate an increase in regional productivity through the influx of construction and station operation workers. Workers will create additional new indirect (service related) jobs in the region through the multiplier effect of direct employment. Construction workforce and their families will increase the population in the area. The expenditures of construction and facility operation workers for food, shelter, and services will create jobs, which will have a SMALL to LARGE positive impact on the region's economy. Job creation will inject millions of dollars in the region's economy, reducing unemployment and creating business opportunities.	Anticipate an increase in regional productivity through the influx of construction and station operation workers. Workers will create additional new indirect (service related) jobs in the region through the multiplier effect of direct employment. Construction workforce and their families will increase the population in the area. The expenditures of construction and facility operation workers for food, shelter, and services will create jobs, which will have a SMALL to LARGE positive impact on the region's economy. Job creation will inject millions of dollars in the region's economy, reducing unemployment and creating business opportunities.	Anticipate an increase in regional productivity through the influx of construction and station operation workers. Workers will create additional new indirect (service related) jobs in the region through the multiplier effect of direct employment. Construction workforce and their families will increase the population in the area. The expenditures of construction and facility operation workers for food, shelter, and services will create jobs, which will have a SMALL to LARGE positive impact on the region's economy. Job creation will inject millions of dollars in the region's economy, reducing unemployment and creating business opportunities.	Anticipate an increase in regional productivity through the influx of construction and station operation workers. Workers will create additional new indirect (service related) jobs in the region through the multiplier effect of direct employment. Construction workforce and their families will increase the population in the area. The expenditures of construction and facility operation workers for food, shelter, and services will create jobs, which will have a SMALL to LARGE positive impact on the region's economy. Job creation will inject millions of dollars in the region's economy, reducing unemployment and creating business opportunities.

Table 10.4-1— Benefit and Costs of the Proposed Project Summarized

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Cost Category	CCNPP Site	Former Thiokol Brownfield Site	Nine Mile Point Site	Ginna Site
Technical and Other Non-Monetary Improvements (for example, New Recreational Facilities and Improvements to Local Facilities)	Co-located with an existing nuclear facility (CCNPP). Anticipate that existing local and county police, fire, and medical facilities and/or personnel would be able to accommodate the influx of construction and facility operation workers. Anticipate that the existing water supply and the township wastewater treatment facilities can accommodate the added increase in population. Anticipate that the existing education and social services facilities can accommodate the increase in population. Construction and operation activities should not have long-term, adverse impacts to recreational use of the surrounding area. Neither technical developments nor recreational enhancements are anticipated at this time from the construction and operation of the proposed nuclear facility. In addition, minor road improvements would occur near the proposed nuclear facility, on an as-needed basis, to support construction and operation activities.	Anticipate the need for additional local and county police, fire, and medical facilities and/or personnel to accommodate the influx of construction and facility operation workers. Anticipate the need for a site-specific wastewater treatment facility/system – either on site or municipal system if available, to accommodate the added increase in population. Anticipate the need for additional education and social services facilities to accommodate the increase in population. Construction and operation activities should not have long-term, adverse impacts to recreational use of the surrounding area. Neither technical developments nor recreational enhancements are anticipated at this time from the construction and operation of the proposed nuclear facility. In addition, minor road improvements would occur near the proposed nuclear facility, on an as-needed basis, to support construction and operation activities.	Co-located with an existing nuclear facility (NMPNPP). The existing police, fire, and medical facilities and/or personnel should be able to accommodate the influx of construction and facility operation workers. Anticipate that the existing water supply and wastewater treatment facilities can accommodate the added increase in population. Anticipate that the existing education and social services facilities can accommodate the increase in population. Construction and operation activities should not have long-term, adverse impacts to recreational use of the surrounding area. Neither technical developments nor recreational enhancements are anticipated at this time from the construction and operation of the proposed nuclear facility. In addition, minor road improvements would occur near the proposed nuclear facility, on an as needed basis, to support construction and operation activities.	Co-located with an existing nuclear facility (Ginna NPP). The existing police, fire, and medical facilities and/or personnel should be able to accommodate the influx of construction and facility operation workers. Anticipate that the existing water supply and wastewater treatment facilities can accommodate the added increase in population. Anticipate that the existing education and social services facilities can accommodate the increase in population. Construction and operation activities should not have long-term, adverse impacts to recreational use of the surrounding area. Neither technical developments nor recreational enhancements are anticipated at this time from the construction and operation of the proposed nuclear facility. In addition, minor road improvements would occur near the proposed nuclear facility, on an as needed basis, to support construction and operation activities.

Table 10.4-1— Benefit and Costs of the Proposed Project Summarized

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Cost Category	CCNPP Site	Former Thiokol Brownfield Site	Nine Mile Point Site	Ginna Site
Environmental Enhancement	Reduction in carbon emissions with the use of nuclear power. The CCNPP site demonstrated an advantage over the alternative sites due to Constellation-owned property The need for transmission line upgrades is significantly less for the CCNPP site than for the alternative sites. If possible, existing transmission lines and corridors would be used and/or expanded for the proposed reactors.	Reduction in carbon emissions with the use of nuclear power.	Reduction in carbon emissions with the use of nuclear power.	Reduction in carbon emissions with the use of nuclear power.

10.5 CUMULATIVE IMPACTS

Sections 10.1 through 10.3 summarize the adverse environmental impacts from construction and operation of Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 that are potentially unavoidable, irreversible or irretrievable. Measures to mitigate these impacts are also discussed. Section 10.4 compares the environmental and economic costs and benefits of the facility. This section summarizes the potential cumulative adverse environmental impacts to the CCNPP region. Cumulative impacts include those that are incremental to past and ongoing activities on the site, along with those that are reasonably foreseeable in the future.

This evaluation of cumulative impacts is based on a comparison between the existing environmental conditions presented in Chapter 2 and the potential adverse environmental impacts of construction and operation detailed in Chapter 4 and Chapter 5, respectively. The evaluation also considers continued operation and license renewal of CCNPP Units 1 and 2.

CCNPP Unit 3 will be co-located on the existing nuclear power plant site currently occupied by CCNPP Units 1 and 2. CCNPP Units 1 and 2 occupy approximately 220 acres (89 hectares), while CCNPP Unit 3 construction is expected to utilize approximately ~~420~~460 acres (~~170~~186 hectares) of which ~~281~~320 acres (~~114~~129 hectares) will be permanently committed to structures and roads.

The CCNPP site consists of approximately 2,070 acres (838 hectares) located in Calvert County, Maryland, on the west bank of the Chesapeake Bay. Other major facilities located nearby include the Patuxent Naval Air Test Center 10 mi (16 km) south of the CCNPP site, and the Dominion Cove Point Liquefied Natural Gas site 3.6 mi (5.8 km) to the south. The 50 mi (80 km) radius surrounding the site includes parts of Maryland, Virginia, Delaware and Washington D.C.

Land use in Calvert County is predominantly farm, forest and residential housing. The CCNPP site consists mostly of mixed deciduous forest in various stages of succession, with a smaller percentage occupied by fields associated with an employee recreational campground and an area consisting of dredge spoils. None of the construction area is farmland. Topography is gently rolling, with steeper slopes along water courses. The site average height above sea level is approximately 100 ft (30 m).

The eastern boundary of the CCNPP site is the Chesapeake Bay. The Chesapeake Bay is approximately 195 mi (313 km) long and varies in width from 3 to 35 mi (5 to 56 km). Freshwater input comes from several major tributaries throughout its length, the largest being the Susquehanna River. The average depth is approximately 21 ft (9 m).

The Chesapeake Bay is a valuable natural resource in that it sustains active commercial and recreational fisheries for blue crab, oyster and several migratory fish species. Harvest, transport and marketing these resources are culturally and economically important to the region.

10.5.1 CUMULATIVE IMPACTS FROM CONSTRUCTION

Construction impacts associated with CCNPP Unit 3 include grading and clearing, allocation of land to material lay-down and parking, use of ground and surface waters, equipment noise and emissions, increased traffic and use of public resources. These activities are consistent with those conducted during the construction of CCNPP Units 1 and 2. Many of the impacts will be temporary and most can be mitigated through the use of best management construction practices and stormwater pollution prevention planning required under State and Federal regulation.

Groundwater is currently utilized by CCNPP Units 1 and 2 for domestic, plant service and demineralized makeup water needs. Groundwater use conforms to an allocation imposed by the Maryland Department of the Environment. Of the 450,000 gpd (1,700,000 lpd) allocated, CCNPP Units 1 and 2 utilize, on average, approximately 388,000 gpd (1,470,000 lpd). Groundwater use during construction will remain within that allocated and its use will eventually be replaced with an onsite desalinization plant for CCNPP Unit 3. However, to date, neither saltwater intrusion nor land subsidence has been reported.

Additional impacts on wetlands, surface waters and groundwater resources may occur due to excavation or other activities that change flow patterns such as construction of sedimentation impoundments, stormwater runoff and dewatering, or that receive construction related waste effluents. It is anticipated that several vernal streams and impoundments will be affected by these activities. Environmental controls will conform to applicable regulations to minimize these effects. Efforts to reclaim areas not occupied by permanent structures or to provide offsetting habitat such as constructed wetlands will also be undertaken.

Protection of important or otherwise unique terrestrial habitats, flora and fauna were also considered in developing the construction plan for CCNPP Unit 3. Surveys of the site were undertaken to identify sensitive locations and protected species and efforts made to limit encroachment on these areas. Examples include the Chesapeake Bay Critical Area that encompasses lands within 1,000 ft (305 m) of mean sea high tide, locations with federally or state designated threatened or endangered species, wetland buffers and contiguous forest blocks. While certain state or federal designated vegetation and faunal species were found onsite, their presence was not found to be unique to areas potentially affected by construction.

Impacts to aquatic organisms found within freshwater impoundments and streams may be realized to the extent these surface waters are removed or water quality is affected. A survey of aquatic resources identified no unique aquatic species occurring with the construction zone. Typical fauna included the eastern mosquito fish, bluegill sunfish, invertebrate larvae, and submerged vegetation. Construction activities that may affect these natural resources, such as erosion and waste water discharge, will be managed using best management practices in conformance with applicable State and Federal permits and regulations.

Because of the preventive measures and corrective actions identified above and the short-term nature of construction activities, the cumulative impact on surface and groundwater from CCNPP Unit 3 construction in conjunction with the continued operation of CCNPP Units 1 and 2 should be small. Further, use of the existing offsite transmission right-of-way will limit the amount of land and related natural resources potentially impacted by construction.

An archaeological survey identified ~~14~~one site~~s potentially~~ eligible for listing on the National Register of Historic Places. ~~Four of these are~~ This site is located within the construction footprint. Phase III Data Recovery ~~II archaeological~~ investigations, and subsequent consultation with the Maryland State Historic Preservation Officer (SHPO) will be performed to mitigate adverse effects from project construction in the event that the site ~~for the four potentially eligible archeology sites to determine their National Register of Historic Places eligibility if they~~ cannot be avoided.

Potential impacts to the Chesapeake Bay would be associated with construction of the cooling water intake and discharge structures and improvements to the barge unloading facility. The Circulating Water Supply System (CWS) and the Essential Service Water System (ESWS) (Ultimate Heat Sink) will utilize independent structures located in ~~the southern portion of the existing CCNPP Units 1 and 2 intake embayment.~~

a forebay constructed on the shoreline terrace approximately 500 ft (152.4 m) south of the southern edge of the Units 1 and 2 curtain wall. Included will be the installation of two 60-inch diameter pipes that will deliver cooling water from the Unit 1 and 2 intake channel to the Unit 3 cooling water system intake forebay. Dredging of the areas approaching the new ~~structures~~ intake pipes and the installation of sheet pile during construction may create some suspended sediment and removal of benthic substrate. Similarly, the dredging required for installation of the subsurface multi-port discharge structure will also require removal of sediment. Refurbishment of the barge slip will include new sheet pile and widening of the slip to receive heavy equipment. Activities in navigable waters will conform to applicable State of Maryland and U.S. Army Corps of Engineers regulations.

Impacts to marine biota will be negligible as previous studies conducted for CCNPP Units 1 and 2 indicate that the benthic substrate will reestablish following construction and that benthic species will quickly recolonize. Further there are no endangered or threatened marine species in the CCNPP site area that could be affected by sedimentation or sediment removal. As a result, cumulative construction impacts in the Chesapeake Bay are not expected.

Potential adverse cumulative impacts to public health and wellbeing stem from construction related noise, increased vehicular traffic, aesthetics and emissions. Noise levels will increase during construction with operation of heavy equipment and vehicles. The State of Maryland has established maximum decibel levels for different land use zones, the most sensitive being residential housing. Estimated noise levels that may occur during construction indicate that due to distance, topography and surrounding forest, levels at the site boundary are expected to meet applicable criteria. For onsite workers, it will be necessary to meet Occupational Safety and Health Administration (OSHA) exposure limits through training and use of personal protective equipment. Cumulative impacts are not expected as construction related noise will cease upon completion of the construction activities.

Traffic will increase during construction as workers commute from within and outside Calvert County. The main highway, Maryland State Highway 2/4, will experience additional traffic during shift change over. A new access road and an additional perimeter road will be constructed onsite to accommodate the excess traffic resulting from CCNPP Unit 3 construction. The access road will remain the primary entrance for CCNPP Unit 3 during operation when the number of workers is dramatically reduced. Heavy equipment and plant components will be barged in avoiding temporary blockage of local highways. Construction of the access road, use of the barge slip for heavy equipment and the decrease in workers following construction will limit cumulative impacts of traffic.

Dust, engine exhaust and other facility operations will result in construction related emissions. Protective actions will be required to ensure that applicable ambient air quality and hazardous pollutant regulations are met. Applicable permits will be obtained and construction practices, such as dust control, will be implemented so that cumulative impacts onsite from emissions are limited and are discontinued following construction.

Topography of the site and its forest canopy will limit visibility of construction activities. The Chesapeake Bay shoreline consists of high 100 ft (31 m) vertical cliffs. Construction activities, except for activities related to intake and discharge construction, will occur inland of the 1,000 ft (305 m) set back further reducing visibility from the water surface. Following construction, the multi-port diffuser will be beneath the surface. The intake structures will be confined to the southern end of the intake embayment and will be visible from certain portions of the Chesapeake Bay but their appearance will be consistent with CCNPP Units 1 and 2 intake structure.

Socioeconomic benefits accrue from capital expenditures as well as the increased number of jobs created during construction and the additional spending the results. It is estimated that peak construction workforce will exceed 3,900 full time equivalents. While it is difficult to predict the number of new jobs created for local county residents compared to those from the greater Washington D.C. area and beyond, it is clear that spending will augment the regional economy.

For example, it is estimated that for each dollar spent an additional $0.69 of indirect revenue would be generated within the region of influence. However, the extent to which construction workers temporarily relocate to within a reasonable commuting distance, will place some added pressure on the availability of housing and public services. No disproportionate impact on minority or low income populations is expected since no specific minority populations were found to exist in Calvert County and St. Mary's County and only one of 55 census groups in St. Mary's County contained a low-income population. None were found in Calvert County.

During construction a total of approximately 410 households would move into Calvert County and 135 into St. Mary's (ER Section 5.8.2.2). The total number of individuals (CCNPP Unit 3 construction and operations workforce) would increase by about 2,466 in Calvert County and 834 in St. Mary's. This influx may impact various public service institutions such as fire, EMS, education and recreational facilities. However, as a percentage, the increase in population is small and existing Comprehensive County Plans are in place to address the needs of an expanding population base.

Construction workers onsite will receive some radiation dose from the continued operation of CCNPP Units 1 and 2. Doses were calculated based on exposure to direct radiation, gaseous effluents and liquid effluents. Total collective dose during the construction period from all onsite sources is calculated to be approximately 14.6 person-rem (0.146 person-Sieverts). The annual maximum dose was calculated to be 38.8 mrem per yr (388 µSv/yr) compared to the public dose criteria of 100 mrem/yr year (1,000 µSv/yr).

In summary, the construction of CCNPP Unit 3 will not result in long-term cumulative impacts that are inconsistent with existing land use. Activities that occur during construction will be managed using best management practices and compliance with applicable regulations to limit both short-term and long-term adverse impacts. Furthermore, impacts will cease following completion of CCNPP Unit 3 and efforts made to reclaim those areas not required for operations.

10.5.2 CUMULATIVE IMPACTS OF OPERATIONS

Potential cumulative adverse impacts from operations include the withdrawal of water from the Chesapeake Bay, discharge of cooling tower blowdown, radiological dose consequences, waste generation, noise from the new hybrid cooling tower and socioeconomic changes. Each of these potential impacts is discussed below.

Because CCNPP Unit 3 will utilize closed-cycle cooling, the amount of cooling water withdrawn from the Chesapeake Bay will be significantly reduced below that required for once-through cooling. The CWS cooling tower is a circular, wet-dry type, mechanical draft tower with drift eliminators, and is approximately 164 ft (50 m) high. It is estimated that the CCNPP Unit 3 CWS will withdraw approximately 34,800 gpm (143,00 lpm) on average to replace evaporative loss, drift, and blowdown from the one mechanical draft cooling tower. Blowdown from the CWS to the retention basin, and ultimately to the Chesapeake Bay will be approximately 17,400 gpm (65,700 lpm). Maximum CWS cooling water makeup demand is approximately 40,400 gpm (153,080 lpm).

The ESWS will utilize closed-cycle cooling, and will have 4 mechanical draft cooling towers. The ESWS cooling towers will each be rectilinear structures, 96 ft (29 m) high, by 60 ft (18.3 m) long, by 60 ft (18.3 m) wide. The ESWS cooling towers will typically be supplied with fresh water makeup from storage tanks that are supplied from a desalinization plant. Makeup flow to the ESWS cooling towers during normal operations will be approximately ~~1,880~~629 gpm (~~7,100~~2,381 lpm). Blowdown from the ESWS cooling towers will be routed to the retention basin, and ultimately the Chesapeake Bay, and will be approximately ~~940~~61 gpm (231 lpm). Maximum ESWS cooling water makeup demand is approximately ~~3,764~~1,490 gpm (~~14,248~~5,640 lpm).

Physical impacts of cooling system water withdrawal could include alteration of site hydrology in the immediate vicinity of the intakes structures. Previous hydrodynamic modeling for CCNPP Units 1 and 2 indicated that their operation would represent less than 1% of tidal flow. Since the amount of cooling water to be used for CCNPP Unit 3 is a small fraction of the intake flow from CCNPP Units 1 and 2, there should be no incremental cumulative adverse impact to the Chesapeake Bay hydrology.

Aquatic impacts attributable to operation of the CCNPP Unit 3 intake structures and cooling water systems include impingement of organisms on the traveling screens and entrainment of fish and invertebrate eggs and larvae within the cooling system. Use of closed-cycle cooling systems at CCNPP Unit 3 will significantly reduce these impacts compared to power plants that operate open-cycle (once-through). In addition, CCNPP Unit 3 will incorporate additional design criteria to limit impingement including intake approach velocities to less than 0.5 ft/sec (0.15 m/sec) as well as a fish return system that is detailed in Section 3.4.

Although some small amount of entrainment will occur, studies indicate that the CCNPP site area is not a spawning area for key species of commercial or recreational value, and that entrainment at CCNPP Units 1 and 2 has not resulted in detectable changes in population levels. Further, the dominant species that occur in the CCNPP site area of the Chesapeake Bay have not been identified as requiring habitat protection.

Blowdown from the cooling towers is returned to the Chesapeake Bay through a submerged multi-port diffuser. The temperature of this discharge will be several degrees above ambient creating a small thermal plume. Modeling of this plume shows that its size and distribution will meet all State water quality criteria and will be sufficiently small that it is unlikely to cause impacts to marine benthos or motile organisms migrating through the area.

Included in the blowdown discharge are chemicals used in biocide treatment and in plant process control. The concentrations discharged will be in conformance with National Pollutant Discharge Elimination System (NPDES) permit conditions and applicable water quality criteria. Further the amount of water being discharge from the closed-cycle system will be small compared to tidal flow such that concentrations of chemicals discharged will rapidly disperse. Solids will be allowed time for settlement and chemical treatment in an onsite retention basin, if required.

Because the use of closed-cycle cooling will limit cooling water requirements, the incremental impact from operation of CCNPP Unit 3 should not result in cumulative adverse ecological impacts.

Excess heat within the CWS will be dissipated to the environment using a hybrid mechanical draft cooling tower with drift eliminators installed. No visible plume is created when a portion of the cooling water evaporates as it leaves the tower and undergoes partial condensation.

Fogging is predicted to occur most frequently onsite and is expected to occur less than 38 hours annually in the vicinity of the cooling towers, reaching the site boundary less than 8 hours annually. Icing is likely to occur most frequently onsite, and is estimated to occur less than 2 hours in all directions on an annual basis. Cloud shadowing is predicted to occur for 38 hours during the spring season, and a total of 113 hours annually on Maryland State Highway 2/4. The relative small size of the four ESWS towers is not expected to contribute to offsite impacts.

Salt deposition from CWS cooling tower operations will occur since the source of makeup water is the Chesapeake Bay. The extent of deposition will be limited through installation of drift eliminators that restrict the amount and size of water particles released from the tower. Model predictions indicate that the maximum salt deposition from the condenser cooling water tower is expected to be below NUREG-1555 (NRC, 1999) significance levels for possible vegetation damage.

While the new cooling towers to be installed and operated as part of the CCNPP Unit 3 closed-cycle cooling water system will create a visible plume, the cumulative impact offsite is expected to vary by season and primarily be a function of viewpoint.

Elevated temperatures within cooling tower systems are known to promote the growth of thermophilic bacteria such as Legionella sp., amoeba such as Naegleria sp., and fungi. Thermophilic organisms are typically associated with freshwater and the Nuclear Regulatory Commission (NRC) has linked health issues to power plants that use cooling ponds, lakes and canals, and that discharge to small rivers. Given that Chesapeake Bay water withdrawn to supply the CWS cooling tower is mesohaline (salinity between 5 to 18 parts per thousand), the growth and dispersion of thermophilic organisms from the CWS cooling tower is not expected to create a public health issue at CCNPP Unit 3.

Makeup water for the ESWS cooling towers will be supplied by a desalinization plant. Biocide treatment will limit the propagation and dispersal of thermophilic organisms in this system including the four small mechanical ESWS cooling towers. Blowdown will combine with the saline discharge of the CWS cooling tower prior to its discharge to the Chesapeake Bay.

Cumulative impacts on land use and the terrestrial environment are expected to be minimal given that the final footprint of the CCNPP Unit 3 structures will be permanently established following construction and no new transmission corridors offsite will be required. Sensitive onsite species that require protection include the bald eagle.

Terrestrial vegetative and faunal species that are critical to structure and function have been identified and will be managed within the Site Management Program. Implementation of the Stormwater Pollution Prevention Plan will also serve to limit future impacts of erosion and inadvertent releases from industrial activities onsite.

Bird mortality from collision is a concern particularly at sites where tall structures such as natural draft cooling towers extend will beyond the tree canopy. The CWS cooling tower to be installed for CCNPP Unit 3 is a low-profile design that will extend 164 ft (50 m) above ground. This compares to the height of a natural draft tower that is typically in excess of 400 ft (122 m).

The sources of noise from operations include the switchyard, transformers, cooling towers and traffic. A baseline noise survey of existing conditions showed that there was no observed offsite audible noise from the operation of CCNPP Units 1 and 2. A modeled prediction of noise from the new CCNPP Unit 3 cooling towers shows that day and nighttime noise levels beyond the site boundary will be below maximum allowable levels. Traffic noise will be limited to normal work day business hours during shift changes. Noise from the new onsite switchyard and transformers will be similar to that currently associated with CCNPP Units 1 and 2. Taken together, the additional noise associated with CCNPP Unit 3 is not expected to alter predictions that noise levels offsite will not represent an adverse cumulative impact.

Air emissions are limited by U.S. EPA standards and permits as well as by OSHA worker health based standards. The primary sources of operational related emissions are the four emergency diesel generators and two station blackout diesel generators. Periodic testing of the diesels is required to ensure their operability. The diesel generator engines are designed to meet the increasingly stringent emission standards.

Additional emissions reductions from the diesel generators will be achieved through the purchase of low sulfur fuels. Carbon dioxide production will be limited to that small amount attributed to testing of the diesel generators. By contrast, CCNPP Unit 3 operation would avoid the emission of approximately 1,731,000 CO_2e (CO_2 equivalent) from coal combustion and 565,000 CO_2e from natural gas combustion.

Exposure of the general public to radiation from the operation of CCNPP Unit 3 is a function of meteorology, relative location, population density, land use practices, harvest and consumption of food sources, as well as the allowable radiological release limits. Dose consequences result from liquid and gaseous releases and from direct radiation. Each of these potential pathways has been analyzed to ensure that applicable public health exposure limits are met.

In addition, the potential dose from the operation of CCNPP Unit 3 has been combined with that predicted for CCNPP Units 1 and 2. Results show that applicable NRC exposure limits are met, and that while there will be dose consequences resulting from operation of CCNPP Unit 3, exposure will remain within applicable limits and will not represent an adverse cumulative impact.

Conservative estimates of radiological dose to biota also demonstrate that exposure to key selected species should result in no observable effects. An existing long-term radiological monitoring program will continue to verify that dose consequences to the general public are as low as reasonably achievable (ALARA).

The uranium fuel cycle will contribute to cumulative impacts from fuel production, transportation, storage and disposal. Related environmental impacts are attributed to land and water use, electrical consumption, chemical effluents, radioactive effluents and waste generation. The cumulative impacts from each of these sources has been reviewed based on an NRC mandated comparative assessment detailed in 10 CFR 51.51(a) (CFR, 2007).

Non-radioactive and mixed-wastes will be produced during CCNPP Unit 3 operations. Typically these consist of recyclables, solid waste debris, and sewage. Cumulative impacts will be managed through implementation of waste minimization practices including the procurement process, allocation of material for work, storage and recycling. Wastes that can not be recycled will be stored and disposed in accordance with applicable state and federal hazardous and non-hazardous waste regulations, and at licensed liquid and solid waste disposal locations. Properly sized and designed onsite facilities for storage will be provided and procedures put in place to deal with potential spills and emergency response.

Socioeconomic impacts (benefits) from long-term CCNPP Unit 3 operation result from the increased operational work force, facility taxes, and generation of competitively priced electricity. Approximately 363 additional employees will be required to support CCNPP Unit 3 operations. Most of these employees are expected to reside primarily within Calvert County and St. Mary's County. The CCNPP Unit 3 workforce will result in increased indirect employment of approximately 1,400 jobs or about 1.9% of the existing two-county work force.

An overall increase in population is expected as families relocate, acquire housing and utilize public services. It is estimated that the additional workforce will increase population within Calvert County and St. Mary's County by approximately 2,500 people compared to the existing 160,774 people. An analysis of available housing suggests that adequate supply is currently available to support the influx of operational employees.

Although some existing police, fire, EMS, and school districts are operating at, or near, capacity, operation of CCNPP Unit 3 would only add 545 direct and indirect households to the region of influence. Representatives of these agencies have indicated that this limited addition would either have no or small impact and would not require mitigation.

While there will be an overall socioeconomic benefit from the operation of CCNPP Unit 3, the cumulative impact, as a percentage, appears to be small. Further, because there are no minority populations prevalent in the area and only one small low-income population in St. Mary's County, there should be no disproportionate impact on these groups.

As described in Section 2.8, several projects have been identified within the CCNPP site area that may contribute to cumulative socioeconomic and environmental impacts. Dominion LNG is planning to expand the Cove Point Liquid Natural Gas Plant located approximately 3.6 mi (5.8 km) south of the CCNPP site. Construction is expected to be completed in 2008. Impacts include construction related activities, use of additional land for on and offsite infrastructure including pipeline expansion, increased shipping, emissions from additional onsite power generation and noise. In addition, approximately 38 new employees will be added to the operational workforce. Potential construction and operational impacts have been reviewed and mitigation measures identified (FERC, 2006).

In addition to expansion of the Dominion LNG facility, additional electrical capacity is being installed at two locations in the CCNPP site region. Two combustion turbine generating units are being added in Easton, Maryland and two at the Chalk Point Generating Station.

Since construction of the LNG facility is to be completed in 2008, there should be limited if any overlap in activities that might impact planned activities at CCNPP Unit 3. Operation of the LNG facility and the addition of additional electrical capacity in Easton and at Chalk Point will contribute to increased emissions but these facilities will be required to meet air quality standards. As a result, the cumulative impacts of these projects should be small.

10.5.3 CUMULATIVE IMPACTS SUMMARY

The potential adverse short-term and long-term impacts from the construction and operation of CCNPP Unit 3 have been identified and actions to mitigate those impacts proposed. Activities to be undertaken during construction and operation of CCNPP Unit 3 are consistent with those currently in place for CCNPP Units 1 and 2. Except for the construction footprint, available land use and the terrestrial environmental will remain unchanged.

Operation of the new unit will require the use of certain natural resources including water withdrawal from the Chesapeake Bay for cooling and will result in the release of process gaseous, liquid and solid wastes, all in conformance with applicable Local, State, and Federal permit requirements and standards. Economic benefits accrue from capital expenditures, additional tax revenue and the jobs created during construction and operation. The environmental assessment demonstrates that cumulative adverse impacts to the vicinity and to the region will be small.

10.5.4 REFERENCES

CFR, 2007. Title 10, Code of Federal Regulations, Part 51, Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions, 2007.

FERC, 2006. Final EIS Dominion Cove Point LNG Project Expansion, Docket Nos. CP05-310-000 et al., U.S. Federal Energy Regulatory Commission, April 28, 2006, Website: www.ferc.gov/industries/lng/enviro/eis/04-28-06-eis-cove.asp, Date accessed: May 26, 2006

NRC, 1999. Standard Review Plans for Environmental Reviews for Nuclear Power Plants, NUREG-1555, Nuclear Regulatory Commission, 1999.