TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

(This page inserted for duplex printing)

6.0 ENVIRONMENTAL EFFECTS OF PROJECT OPERATION

6.1 SITE OPERATION ACTIVITIES AND IMPACTS

In this section, the Co-Applicants describe the activities associated with the operation of the facility that have the potential of impacting the environment:

- CWS cooling tower emissions,
- Waste disposal,
- Water appropriation, and
- Socioeconomic effects.

6.2 LAND USE IMPACTS OF OPERATION

The following sections describe the impacts of the CCNPP Unit 3 operations on land use at the CCNPP site, the 8 mi (13 km) vicinity, and associated transmission line corridors.

6.2.1 The Site and Vicinity

Impacts to land from the operation of CCNPP Unit 3 will be associated with the use of Chesapeake Bay water in the operation of the cooling tower for CWS. The cooling towers serving the ESWS are smaller than the CWS cooling tower, use desalinated water, and will have a considerably smaller impact to land.

6.2.1.1 Cooling Water System Impacts

The cooling system for CCNPP Unit 3 will be a closed-cycle, wet and dry hybrid cooling system, consisting of a single mechanical draft cooling tower for heat dissipation. The tower will be approximately 164 ft (50 m) high with an overall diameter of 528 ft (161 m). Makeup water for the proposed unit will be taken from the Chesapeake Bay at a rate of 37,748 gpm (131,535 lpm), assuming two cycles of concentration. The CWS is described more fully in Section 2.3.3. (As is described in §3.0 of this Technical Report, certain studies were conducted prior to final design. This is particularly true with respect to the cooling tower study, which was conducted while the Co-Applicants were considering building two reactors with two cooling towers. Similarly, the study was conducted prior to the decision to add plume abatement technology. In light of these changes, the reader should exercise caution when referring to the background documents and comparing information to the current design described in this document).

The four smaller, ESWS cooling towers will have a considerably smaller impact than the CWS. Normal heat loads to the ESWS cooling towers are approximately 3% of the heat load to the CWS cooling tower. The maximum heat load is less than 7% of the CWS cooling tower heat load. Any impacts from the heat dissipation to the atmosphere by the ESWS cooling towers will be negligible. Moreover, the ESWS cooling towers are intended for freshwater use and therefore will cause negligible salt drift and particulate emissions. Therefore, the ESWS cooling towers are not considered further in the analysis.

The CWS will occupy an area of approximately 5 acres (2 hectares). The cooling tower for CCNPP Unit 3 will be located south-southeast of the CCNPP Unit 3 power block. The cooling tower will be approximately 3,200 ft (970 m) to the nearest site boundary to the south-southeast and approximately

1,545 ft (471 m) to the closest portion of the 1,000 ft (305 m) Chesapeake Bay Critical Area (CBCA) located to the northeast along the Chesapeake Bay.

Ordinarily a visible mist or plume is created because of the microscopic droplets of water that are entrained in the air discharged from the cooling tower. These droplets will eventually evaporate at some distance from the tower denoted as the visible plume length. The CCNPP Unit 3 Cooling tower is a hybrid design and will not create any visible plume. The SPX Cooling Technologies design includes the injection of heated ambient air above the demisters at approximately the same rate (scfm) as in the wet section. The hot water from the main condenser will increase the temperature of the air above the demisters to above the dew point, i.e., at a temperature that will decrease the relative humidity and allow for the microscopic water droplets to evaporate completely. This evaporation process will be carefully controlled by monitoring a number of ambient parameters including the temperature, atmospheric pressure and relative humidity. Adding the right amount of heat above the demisters will prevent the formation of a visible plume at the tower exit or further downwind from the tower. There will not be any visible plume at the top of the tower or at any distance downwind from the tower. The amount of heated air added to the system is not sufficient to allow for partial recondensation of the water vapor as one might observe rising from a cup of hot tea. More technical information on the cooling tower operation can be found at

http://spxcooling.com/pdf/BA_06015_e_Hybrid.pdf .

Because there will be no water droplets emitted from the tower, there is no potential for shadowing, fogging, icing, localized increases in humidity, or water deposition.

The elimination of the droplets will not affect the salt or solid particles that are entrained in the moist air and discharged from the demisters. The water droplets evaporate by the time the parcel of air rises from the demisters to the top of the tower, a distance of about 80 ft (24 m). The salt particles will be discharged from the tower as part of the approximately 130,000,000 scfm air stream that will leave the tower. However, the size of the particle being discharged is a fraction of the size of a water droplet before evaporation and will be carried further downwind than would the droplets. The size of the particles that will be discharged is estimated to be a maximum of about 15 microns. Particles of this size are easily suspended in air and act as a gas in the dispersion process. As a result we expect very little deposition in the immediate vicinity of the tower.

Length and Frequency of Elevated Plumes

There will be no visible plume discharged from the CWS cooling tower under any meteorological condition. It is anticipated that the plume abatement system will operate at all times necessary to eliminate the plume.

Ground-Level Fogging and Icing

Because there are no microscopic water droplets emitted from the tower and the temperature of the air stream is just slightly above the ambient temperature, no fogging is expected to occur. Similarly, icing will not occur as a result of the operation of the hybrid cooling tower.

Salt Deposition

The EPA's AERMOD was used to estimate the amount of salt or solids that would be deposited in the immediate area of the site. The maximum predicted salt deposition rate from the cooling tower is provided in Table 6.2-1. The maximum predicted salt deposition rate is below the significance level established by the NRC for possible vegetation damage of 8.9 lbs per acre per month (10 kg per hectare per month) in all directions from the cooling tower, during each season and annually. NUREG 1555, § 5.33.2. Therefore, minimal impacts to vegetation from salt deposition are expected for both onsite and offsite locations.

Salt deposition near the tower is predominately due to the larger particles being emitted from the cooling tower, i.e., mainly the particles larger than 10 microns. PM10 represents suspended particulates that are presumed to act like a gas when emitted into the atmosphere. About 80% of the particles emitted will be in the form of PM10 on a mass basis. Eventually the PM10 will settle out or serve as a nucleus for water droplet formation at significant distances from the source.

Table 6.2-1 Maximum Predicted Salt Deposition Rate

Maximum predicted deposition rate	2.1 lbs/acre per month (2.4 kg/hectare per month)
Distance to maximum deposition	1,600 ft (500 m)
Direction to maximum deposition	Northeast
Maximum deposition at the CCNPP Unit 3 substation/switchyard	0.3 lbs/acre per month (0.3 kg/hectare per month)
Maximum deposition at the CCNPP Units 1 and 2 substation/switchyard	0.2 lbs/acre per month (0.2 kg/hectare per month)

6.2.2 Transmission Corridor Impacts

In general, a transmission line owner ensures that land use in the corridors and underneath the high voltage lines is compatible with the reliable transmission of electricity through established corridor vegetation management and line maintenance procedures. These procedures will continue to be used to maintain the corridor and transmission lines. Vegetation communities in these corridors are kept at an early successional stage by mowing and application of herbicides and growth-regulating chemicals.

The land use impacts to offsite transmission corridors from operation of CCNPP Unit 3 are expected to be the same as impacts from the existing CCNPP Units 1 and 2, and consideration of mitigation alternatives is not warranted.

6.2.3 Impacts On Historic Sites and Cultural Resources

The cultural resource survey of the CCNPP site identified fourteen archaeological sites, four of which are considered eligible for inclusion on the National Register of Historical Places. The survey also identified five architectural resources, four of which are considered eligible for the National Register of Historical Places.

Five of the eight historic properties (archeological and architectural) would not be affected by operation of CCNPP Unit 3 due to the mitigation actions that will be taken during construction activities. The remaining three historic sites will not be affected by the operation of the facility.

As described in Section 5.2.3, portions of the roadbed for the former Baltimore and Drum Point Railroad will be affected during construction of CCNPP Unit 3, resulting in a potentially adverse effect to this property. However, other portions both on and off the CCNPP site property will remain intact and remain eligible for inclusion on the National Register of Historic Places. The Preston's Cliff property and the

Parran's Park property will also remain intact and eligible for inclusion on the National Register of Historic Places post-construction of CCNPP Unit 3. Onsite areas previously disturbed during CCNPP Unit 3 construction, will be maintained during operation but this will have a minimal effect on the three properties.

The Maryland State Historic Preservation Officer (SHPO) has been consulted throughout completion of the Phase Ia and Ib surveys to ensure compliance and maintain a strong working relationship. The results of the Phase Ia and Ib surveys were documented in the March 2007 CCNPP Unit 3 Draft Interim Report – Phase 1b Cultural Resources Investigation. This report was submitted to the Maryland SHPO for review and consultation under Section 106 of the National Historic Preservation Act. Comments from the Phase Ia and Ib surveys were received from the Maryland SHPO in a letter dated June 7, 2007.

Phase II archaeological investigations and subsequent SHPO consultation will be conducted on potentially eligible archaeological resources that are located within the proposed project area and cannot be avoided, to determine their eligibility. Upon completion of any Phase II investigations and SHPO consultations, assessments of effect on the National Register of Historical Places eligible resources on the project site will be determined and consultation conducted with the SHPO to identify measures to avoid, minimize, or mitigate any adverse effects as required by Section 106 of the National Historic Preservation Act.

With maintenance and operations activities, there is always the possibility for inadvertent discovery of previously unknown cultural resources or human remains. Prior to initiating land disturbing activities, procedures will be developed which include actions to protect cultural, historic, or paleontological resources or human remains in the event of discovery. These procedures will comply with applicable Federal and State laws. Section 106 of the National Historic Preservation Act and Article 83B Section 5-617 and 5-618 of the Maryland Code, respectively, require any project requiring licenses, permits, or that are funded by State and Federal agencies to examine the impact of their undertaking on significant cultural resources and to take steps to avoid, reduce or mitigate any adverse effects. The Code of Maryland, Criminal Law Title 10, Subtitle 4, Sections 10-401 through 10-404 requires consultation with the State of Maryland for removal and reburial of human remains. The Code of Maryland, Health – General, Title 4, Subtitle 2, Section 4-215 requires a permit to disinter a burial.

The continued use of the existing transmission corridors by the proposed project would not result in new impacts to cultural and historical resources. There would be no new offsite transmission corridors or offsite transmission lines for the proposed project. Because there will be no new corridors or construction of new transmission lines within the existing corridors required for this project, there will be no new impacts as the result of this project.

Previously recorded historic or archaeological resources located within 10 mi (16 km) of the CCNPP site were also identified through research of existing records. Research identified 1,029 previously inventoried cultural resources. There are no anticipated impacts from the operation of CCNPP Unit 3 on these sites.

The operation of CCNPP Unit 3 would have a minimal impact on historic or cultural resources.

6.3 IMPACTS OF OPERATION ON GEOLOGY

There are no anticipated geological impacts from operations of the facility.

6.4 IMPACTS OF OPERATION ON HYDROLOGY

CCNPP Unit 3 will require water for cooling and operational purposes. The source of this water will be the Chesapeake Bay. Approximately half of this water will be lost by evaporation and cooling tower drift. The remainder will be cooling tower blowdown which will be combined with the Desalination Plant and the wastewater treatment plant effluents and returned to the Bay. The discharges from the CCNPP Unit 3 will be in compliance with National Pollutant Discharge Elimination System (NPDES) discharge permit requirements. CCNPP Unit 3 will apply for a NPDES permit which will include a Storm Water Pollution Prevention Plan (SWPPP) to prevent or minimize the discharge of potential pollutants with the storm water discharge and will reflect the addition of new paved areas and facilities and changes in drainage patterns. Impacts from increases in volume of pollutants in the storm water discharge will be minimized by implementation of best management practices (BMP). Potential impacts from chemical constituents in the cooling discharges from CCNPP Unit 3 will be minimized via compliance with NPDES permit requirements. CCNPP Unit 3 will maintain engineering controls that prevent or minimize the release of chemical constituents to the Chesapeake Bay. Concentrations in the cooling water discharge will be limited by NPDES requirements and will be minimal or non-detectable in the Chesapeake Bay.

6.4.1 Water Demand

Normal plant operations will require from the Chesapeake Bay an estimated demand of 37,788 gpm (143,043 lpm) from which 3,040 gpm (11,508 lpm) is processed through the Desalination Plant to supply fresh water for the ESWS. During refueling outages, which occur approximately every two years and last approximately 1 month, the maximum water demand will rise to 43,480 gpm (164,590 lpm) for the initial period of plant cool down and then decrease to include essentially only the fresh water demand for the onsite workforce.

For the purpose of estimation, a fresh water demand value of 30 gpd (114 lpd) per person is assumed. During outages, the permanent onsite workforce of approximately 363 would increase by an estimated 750 additional workers. Using this value, fresh water demand would increase from 10,890 gpd during normal operations to 33,390 gpd during major outages. This increase in fresh water demand correlates to an increase in makeup water demand for the Desalination Plant of approximately 39 gpm (148 lpm) or 56,160 gpd at a 40% recovery rate. Sanitary effluents are estimated at 20 gpm (76 lpm) during normal operations, and would increase to 36 gpm (136 lpm) during major outages, which is the design capacity for the conceptual design of the Waste Water Treatment Plant. These increases represent relatively small fractions of the total expected Chesapeake Bay water demand.

CCNPP Unit 3 is designed to use the minimum amount of water necessary to ensure safe, long-term operation of the plant. The intake for CCNPP Unit 3 will be located inside the existing intake embayment for CCNPP Units 1 and 2. The discharge outfall piping will enter the bay near the existing barge slip and extend approximately 550 ft (170 m) offshore through a 30 in (80 cm) diameter buried pipe to a multi-port diffuser system.

Circulating Water Supply System

CCNPP Unit 3 will utilize a closed-loop CWS. The system will use a single mechanical draft cooling tower for heat dissipation. The CWS cooling tower is a hybrid design wherein heat is added; just above the demisters to evaporate all of the entrained water that would pass through the demisters and eliminate the visible plume. The cooling tower system requires makeup water to replace that lost to evaporation, drift (entrained in water vapor), and blowdown (water released to purge solids).

Makeup water for the mechanical draft CWS cooling tower system will be withdrawn from the Chesapeake Bay. Makeup water for the CWS will be pumped at a maximum rate of 40,440 gpm (153,082 lpm). At the maximum makeup rate, water lost by evaporation and blowdown returned to the Chesapeake Bay will each be approximately equal at 20,200 gpm (76,465 lpm). Average makeup water flow to the CWS is expected to be approximately 34,748 gpm (131,535 lpm), with water lost by evaporation and blowdown returned to the Chesapeake Bay each being approximately equal at 17,355 gpm (65,695 lpm).

The water balance is affected minimally by drift. Maximum drift losses will be less than 0.0004% of the circulating water flow (777,560 gpm (3.0 million lpm)). The cooling tower is expected to operate at 2 cycles of concentration.

The ESWS, under normal plant operations with two trains operating, will operate at a nominal recirculated flow rate of approximately 19,075 gpm (72,207 lpm). The maximum fresh water makeup rate from the Desalination Plant required under normal operations is estimated to be 1,882 gpm (7,124 lpm) to offset maximum evaporation rate (approximately 940 gpm (3,560 lpm)), maximum blowdown rate (approximately 940 gpm (3,560 lpm)), and drift loss (approximately 2 gpm (8 lpm)). The maximum makeup rate from the Chesapeake Bay to the ESWS cooling towers will be 3,748 gpm (14,188 lpm) to accommodate the maximum evaporation rate and drift loss for two ESWS (Ultimate Heat Sink (UHS)) cooling towers during DBA conditions.

Desalination Plant

During operations, CCNPP Unit 3 will not withdraw groundwater for use at the site. Consequently, operation of CCNPP Unit 3 will require a consistent source of fresh water makeup for cooling purposes. A reverse-osmosis (RO) Desalination Plant will be used to provide fresh water for the plant demineralized water system, potable and sanitary water systems, and UHS makeup water system. The Desalination Plant will use stage media filtration, with a one pass seawater reverse osmosis (SWRO) at 40% recovery. The system will also include seawater feed pumps, multimedia filters, chemical injection system, and an RO permeate tank. The Chesapeake Bay will be the source of water for the Desalination Plant.

The Desalination Plant will remove the high concentration of salts and minerals from the Chesapeake Bay source water. During the production of desalinated water, a percentage of the source water is concentrated and is unusable. The product water recovery relative to input water flow is 15% to 50% for most seawater Desalination Plants. That is, for every 100 gal (379 l) of seawater, 15 to 50 gal (57 to 189 L) of desalinated water is produced along with brine wastewater containing a higher concentration of dissolved solids. A Desalination Plant's recovery rate varies, mainly because plant operations and efficiencies depend on site-specific conditions.

The general process of reverse osmosis is described as follows. High pressure makeup water enters the RO trains, where the water passes through the membranes, and the dissolved salts are rejected. Permeate, or product water, is collected from the end of each membrane element, and becomes the product of the purification process. As the reject water flows along the "brine channel", or coarse medium, it becomes increasingly more concentrated.

This concentrated raw water is called the reject stream, or concentrate stream. Operation at 50% recovery would result in a reject stream that is twice as concentrated as the feed, which is essentially the same concentration as the blowdown from the CWS cooling tower. The Desalination Plant is expected to operate at a 40% recovery rate that will result in a less concentrated reject stream. The reject stream carries the concentrate from the RO trains to the wastewater retention basin prior to being released to the Chesapeake Bay along with the cooling tower blowdown.

Preliminary studies indicate that Desalination Plant water capacity will be 1,750,000 gpd (1,215 gpm, or 4,599 lpm). Desalination Plant demand for CCNPP Unit 3 will be approximately 1,250,000 gpd (4,731,000 lpd), with an additional capacity of 500,000 gpd (1,893,000 lpd) available. The conceptual water requirements for the systems that will be served by desalination are shown in Table 6.4-1.

Makeup water for the Desalinization Plant will be taken from the makeup line for the CWS, which utilizes the Chesapeake Bay as its source. The Desalinization Plant will have a membrane filtration pretreatment followed by the reverse osmosis process. Therefore, assuming 10% filtration waste and operation at 40% recovery, 3.89 million gpd (14.7 million lpd) of water will be withdrawn from the Chesapeake Bay to supply the Desalination Plant.

The Desalination Plant reject stream would be directed to a retention pond where it will mix with, and be diluted by, circulating water blowdown from CCNPP Unit 3 prior to discharge to the Chesapeake Bay.

Table 6.4-1 Desalination Plant Demand

System	Demand			
	gpm	lpm	gpd	lpd
Two ESWS Cooling Towers	1882	7,124	2,710,080	10,258,560
Potable Water System	20	76	28,800	109,440
Makeup to Demineralizer	80	303	115,200	436,320
Fire Protection	3	11	4,320	15,840
Additional Capacity	350	1,325	504,000	1,908,000
Total	2,335	8,839	3,362,400	12,728,160

6.4.2 Surface Water Availability

The Chesapeake Bay contains nearly 18 trillion gallons (68 trillion liters) of water and is refreshed by rivers at an annual average rate of 77,500 ft^3/s (2,190 m^3/s), and a flowrate of 30,800 ft^3/s (872 m^3/s) during periods of low freshwater input to the Chesapeake Bay. The volume of water that will be lost to evaporation from the CCNPP Unit 3 cooling tower and ESWS cooling towers is negligible compared with the amount of water in the Chesapeake Bay, and consumptive losses of this magnitude will not be discernible. No measurable impact of consumptive water use on the Chesapeake Bay water level is expected, and operation of CCNPP Unit 3 will therefore have an insignificant effect on the availability of water from the Chesapeake Bay.

The major non-consumptive surface water use categories in the vicinity of the site are recreation, fisheries, marinas, parks, and transportation. The recreational activities include swimming, fishing and boating along the Patuxent River and in the Chesapeake Bay. Transportation on the Chesapeake Bay will not be affected by the construction or operation of CCNPP Unit 3. No effect on fisheries, navigation, or recreational use of the Chesapeake Bay is expected.

6.4.3 Impacts on the Chesapeake Bay

During operation of CCNPP Unit 3, the primary external impact will be the appropriation of Chesapeake Bay water and the discharge of cooling tower blowdown water to the Chesapeake Bay. Once in operation, there will be little ongoing impact to water bodies other than the Bay.

6.4.3.1 Water Intake Impacts

The existing intake system for CCNPP Units 1 and 2 includes an intake channel, and an embayment established by a curtain wall. The CCNPP Unit 3 intake for the CWS will be located on the southern edge of the intake embayment. The intake for the UHS makeup will be located to the east immediately adjacent to the CWS intake. The CCNPP Unit 3 intakes will be set back from the intake embayment and situated at the end of a 123 ft (37 m) long, 100 ft (30 m) wide channel. Based on operational experience at CCNPP Units 1 and 2, it is expected that no maintenance dredging will be needed to keep the intake area clear.

The Desalination Plant is the source of the makeup water for the ESWS during normal and shutdown/cooldown conditions. The Desalination Plant is supplied by the Chesapeake Bay via the intake structure for the CWS.

Design approach velocities for both CCNPP Unit 3 intake structures will be less than 0.5 ft/s (0.15 m/s). The flow through the CCNPP intake channel is determined by plant operating conditions. The intake structures will incorporate fish and invertebrate protection measures that maximize impingement survival. The through trash rack and through screen mesh flow velocities will be less than 0.5 ft/s (0.15 m/s). The screen wash system consists of two screen wash pumps that provide a pressurized spray to remove debris from the water screens. A fish return system will be provided even though flow velocities through the screens are less than 0.5 ft/sec (0.15 m/sec) in the worst case scenario (minimum Chesapeake Bay level with highest makeup demand flow).

In the UHS makeup water intake structure, one makeup pump will be located in each pump bay, along with one dedicated traveling band screen and trash rack.

The CCNPP Unit 3 CWS and UHS makeup intakes will meet the U.S. Environmental Protection Agency (U.S. EPA) Phase 1 design criteria. The overall percentage of Chesapeake Bay water entrained will remain less than 1%, with the maximum additional makeup required to meet the CCNPP Unit 3 cooling water requirement of 40,440 gpm (153,082 lpm).

Fish impingement and entrainment will occur, even though low velocity approach and screens will be used. CCNPP Unit 3 will employ the same fish return impingement/entrainment mitigation techniques currently utilized by CCNPP Units 1 and 2 to minimize the impact on aquatic resources. The fish loss associated with impingement/entrainment will be negligible.

6.4.3.2 Water Discharge Impacts

U.S. EPA declared the Chesapeake Bay an impaired water body in 1998 under the Federal Water Pollution Control Act because of excess nutrients and sediments. The area of the Chesapeake Bay near the CCNPP site is included on the Maryland Clean Water Act Section 303(d) list for impaired watersheds. Chesapeake Bay water is required to meet federal regulatory water quality standards by 2010. The potential effects of the discharge from all CCNPP units will be considered in developing the NPDES Permit for CCNPP Unit 3. CCNPP Unit 3 will comply with applicable State of Maryland regulations requiring the design of the cooling water intake and discharge structures to incorporate the Best Technology Available (BTA) to minimize adverse environmental impacts (COMAR 26.08.02.03).

The discharge outfall for CCNPP Unit 3 will be located approximately 1,200 ft (366 m) southeast of the CCNPP Unit 3 intake structures. The discharge piping will extend approximately 550 ft (168 m) east from the outfall into the Chesapeake Bay. The discharge structure will utilize a single 30 in (76 cm) diameter pipe having three outlet nozzles. The preliminary centerline elevation of the diffuser nozzles is 3 ft (0.9 m) above the bay bottom. Riprap will be placed around the discharge point to resist potential scour due to the discharge jet from the diffuser nozzles.

The CCNPP maximum Unit 3 CWS cooling tower discharge is estimated to be 20,200 gpm (76,500 lpm). A common retention basin will hold cooling tower blowdown and effluents from the proposed Desalination Plant and wastewater treatment plant before discharging, further reducing thermal impacts to receiving waters. Effluent from the retention basin, which will contain dilute quantities of chemicals and dissolved solids, and be slightly elevated in temperature, will be discharged to the Chesapeake Bay within the limits of the site NPDES permit. When discharged and diluted, this small amount of slightly contaminated water, approximately 0.001% of low flow conditions in the Chesapeake Bay, would be expected to have small impacts.

6.4.3.3 Chemical Impacts

The water lost to evaporation during the operation of the cooling tower for CCNPP Unit 3 must be continuously replaced with makeup water. To prevent build-up of solids, a small portion of the circulating water stream with elevated levels of solids is drained or blown down. Cooling towers concentrate solids (minerals and salts) and organics that enter the system in makeup water. The water chemistry must be maintained with anti-scaling compounds and corrosion inhibitors. Similarly, because conditions in cooling towers are conducive to the growth of fouling bacteria and algae, biocides must be added to the system. These are normally chlorine or bromine-based compounds, but occasionally hydrogen peroxide or ozone is used. Table 6.4-2 lists the water treatment chemicals that are expected to be used and the estimated quantities required.

As opposed to the CWS cooling tower, which uses brackish Chesapeake Bay water as its makeup water source, the ESWS cooling towers will typically be supplied with fresh water makeup from the Desalination Plant, and will only use Chesapeake Bay water as an emergency backup source when freshwater makeup from storage tanks or the Desalination Plant is not available. The build up of solids and solid scale formation in the ESWS cooling towers will therefore be substantially less than for the CWS cooling tower. The ESWS cooling towers will use the water treatment chemicals described above, but to a lesser degree than the CWS cooling tower.

Limited treatment of raw water to prevent biofouling in the intake structures and makeup water piping may be required. Additional water treatment will take place in the cooling tower basin, and will include the addition of biocides, anti-scaling compounds, and foam dispersants. Sodium hypochlorite and sodium bromide are available to be used to control biological growth in the existing CWS and will likely be used in the system as well.

The NPDES permit which must be obtained prior to the startup of CCNPP Unit 3, will likely specify threshold concentrations of Free Available Chlorine (when chlorine is used) and Free Available Oxidants (when bromine or a combination of bromine and chlorine is used) in cooling tower blowdown when the dechlorination system is not in use.

Dechlorination is a component of the planned Unit 3 project site wastewater treatment plant, which is discussed below. Lower discharge limits would apply to effluent from the dechlorination system (which is released into Chesapeake Bay) when it is in use. The CCNPP Unit 3 NPDES permit is expected to contain limits for discharges from the cooling towers for two priority pollutants, chromium and zinc, which are widely used in the U.S. as corrosion inhibitors in cooling towers.

Table 6.4-2 Water Treatment Systems

System	Point(s) of Addition	Chemical Additives	Estimated Quantity	Operating Cycle(s)
Circulating Water Treatment System [a]	Circulating Water Supply System (CWS) Makeup CWS Piping CWS Blowdown	Sodium Hypochlorite (10-20 Wt. %) with Sodium Hydroxide (1-5 Wt. %) Dispersant Sodium Bisulfite (40 Wt. %) Antifoam	547,500 gal/yr (2,072,513 l/yr) 383,000 lb/yr (173,726 kg/yr) 191,500 lb/yr (86,863 kg/yr) 18,250 gal/yr (69,084 l/yr)	Normal Operating Conditions and Normal Shutdown/Cooldown
Essential Service Water System (ESWS) Cooling Tower Water Treatment System [b]	ESWS Cooling Tower Makeup ESWS Cooling Tower Blowdown	Sodium Hypochlorite (10-20 Wt. %) with Sodium Hydroxide (1-5 Wt. %) Dispersant	2,000 gal/yr (7,571 l/yr)	Normal Operating Conditions and Normal Shutdown/Cooldown
Demineralized Water Treatment System [c]	Demineralized Water Distribution System Makeup	Sulfuric Acid (93 Wt. %) Sodium Hydroxide (50 Wt. %)	2,650 gal/yr (10,031 l/yr) 2,400 gal/yr (9,085 l/yr)	Normal Operating Conditions and Normal Shutdown/Cooldown
Drinking Water Treatment System [d]	Potable and Sanitary Distribution System Makeup	Sodium Hypochlorite (10-20 Wt. %) with Sodium Hydroxide (1-5 Wt. %) Iron-based Sorbent	200 gal/yr (757 l/yr) 12 ft3/yr (0.34 m3/yr)	Normal Operating Conditions and Normal Shutdown/Cooldown
Liquid Waste Storage System and Liquid Waste Processing System [d, e]	Influent Waste Water	Sulfuric Acid (93 Wt. %) Sodium Hydroxide (50 Wt. %)	22,900 gal/yr (86,686 l/yr) 2,400 gal/yr (9,085 l/yr)	Normal Operating Conditions and Normal Shutdown/Cooldown

System	Point(s) of Addition	Chemical Additives	Estimated Quantity	Operating Cycle(s)
Waste Water Treatment Plant [d]	Potable and Sanitary Distribution System Effluent	Sodium Hypochlorite (10-20 Wt. %) with Sodium Hydroxide (1-5 Wt. %)	800 gal/yr (3,028 l/yr)	Normal Operating Conditions and Normal Shutdown/Cooldown
		Sodium Thiosulfate (100 Wt. %)	1,000 lb/yr (454 kg/yr)	
		Soda Ash	12,000 lb/yr (5,443 kg/yr)	
		Alum (5 Wt. %) with Polymer	200 gal/yr (757 l/yr)	

Key:

gal/yr – gallons per year
l/yr – liters per year
ft3/yr – cubic feet per year
m3/yr – cubic meters per year
lb/yr – pounds per year
kg/yr – kilograms per year

Notes:

a. The CWS has no safe shutdown or accident mitigation functions. Sodium hypochlorite will typically be added to makeup water. Sodium hypochlorite and dispersant may be added to piping. Dispersant may contain 10 to 20 weight percent 1-hydroxy-1,1-diphosphonoethane. Chlorine may also be added to piping for prevention of legionella. All four chemicals listed may be added to blowdown. The sodium bisulfite will be added to the blowdown only. The antifoaming agent will contain between 60 and 100 weight percent petroleum distillate. The estimated quantities of chemical additives are totals used throughout the Circulating Water Treatment System.

b. During a design basis accident (DBA), the ESWS Cooling Tower Water Treatment System is assumed to be non-operational. The estimated quantity of chemical additives is a combined total for both chemicals listed.

c. The estimated quantities of chemical additives are based on the existing CCNPP Units 1 and 2 Demineralized Water Treatment System which uses the indicated chemicals for the regeneration of condensate demineralizers. The actual quantities of chemical additives will depend on how the demineralizer for CCNPP Unit 3 will be used (i.e., full-flow demineralizers use higher quantities).

d. Types and estimated quantities of chemical additives are based on those used at an existing plant.

e. An anti-foaming agent, complexing agent and/or precipitant may also be used to promote settling of precipitates.

Operation of the CCNPP Unit 3 cooling tower systems will be based on 2 cycles of concentration. As a result, levels of solids and organics in cooling tower blowdown will be approximately twice as high as ambient concentrations in the Chesapeake Bay. Blowdown wastewater from the cooling tower and similar waste from the saltwater Desalination Plant (membrane filtration pretreatment and saltwater reverse osmosis) will discharge to a retention basin to allow time for settling of suspended solids and to allow additional chemical treatment of the wastewater, if required, prior to discharge to the Chesapeake Bay. The final discharge will consist of cooling tower blowdown from the CWS cooling tower, the ESWS cooling towers, the Desalination Plant, and site waste streams, including the domestic water treatment and circulating water treatment systems.

Under normal conditions, 19,425 gpm (73,531 lpm) will be discharged by pipe from the retention basin into the Chesapeake Bay; a maximum discharge of 23,227 gpm (87,923 lpm) is anticipated. Because the discharge stream volume will be small relative to the volume of the Chesapeake Bay, concentrations of solids and chemicals used in cooling tower water treatment will rapidly dilute and approach ambient concentrations in the Chesapeake Bay after exiting the discharge pipe.

The cooling tower blowdown and Desalination Plant wastewater effluent volume entering the Chesapeake Bay from the common CCNPP Unit 3 retention basin will be small and any chemicals it contains low in concentration. The operation of CCNPP Unit 3 will comply with a MDE-issued NPDES permit, and the applicable state water quality standards. All biocides or chemical additives in the discharge will be among those approved by the U.S. EPA and the State of Maryland as safe for humans and the environment.

The area of the Chesapeake Bay near CCNPP Unit 3 is included on the Maryland Clean Water Act, Section 303(d) List because of high nutrient levels and low dissolved oxygen (DO) concentration (i.e., <5 mg/L) (MDE, 2004). Section 303(d) of the Federal Water Pollution Control Act requires states to identify waters that are impaired by pollution, even after application of pollution controls. For those waters, States must establish a total maximum daily load (TMDL) of pollutants to ensure that water quality standards can be attained.

A State of Maryland regulatory deadline of 2011 exists to establish TMDLs for the Chesapeake Bay. Because of this mandate and the State enforcement of environmental design of discharge structures, the effluent from CCNPP Unit 3 will be monitored, and any necessary measures will be taken to mitigate impacts from possible pollutants and low dissolved oxygen content in the effluent. As a result, it is not expected that there will be any negative effect on the DO concentration in the Chesapeake Bay due to the CCNPP Unit 3 discharge plume.

Based on the above, impacts of chemicals in the permitted blowdown discharge wastewater to the water quality of the Chesapeake Bay will be negligible and are not expected to warrant additional mitigation.

The CCNPP Unit 3 Wastewater Treatment Plant (WWTP) will also discharge chemically treated water to the Chesapeake Bay. Wastewater generated onsite during operation of CCNPP Unit 3 will be treated using standard wastewater treatment plant processes. The treated wastewater will meet all applicable health standards, regulations, and TMDLs as set by MDE and the U.S. EPA.

The CCNPP Unit 3 WWTP will be designed with a typical two-stage clarifier type treatment system which incorporates a lift station, an anoxic mixing chamber, an oxidation ditch, a series of clarifiers, media filtration, a chlorination system, and a dechlorination system. The treatment process is described below.

Raw sewage generated during the operation of CCNPP Unit 3 will flow into a wet well and then be pumped to the anoxic mixing chamber. The collection of sewage and the subsequent pumping help to grind waste materials to a uniform size and add oxygen to the liquid waste stream. In the anoxic mixing chamber incoming sewage is mixed with activated sludge from the clarifiers. This begins the aerobic digestion process. The activated sludge adds the necessary microorganisms to the incoming sewage and the microorganisms digest the organic constituents in the incoming wastewater. Aerobic microorganisms use the incoming wastes for food, a source of energy, and reproduction. The products of aerobic digestion are water, carbon dioxide, and more microorganisms.

Microorganisms and oxygen must be present in sufficient numbers to consume the incoming organic material and oxidize ammonia and nitrogen. Optimum conditions for the microorganisms are maintained by controlling the pH, oxygen concentration, and biomass in the system.

Sewage then flows into the oxidation ditch and then into the primary clarifier. The primary clarifier separates the solids (sludge) from the clear liquid. The sludge is then pumped back into the anoxic mixing chamber, or collected and sent to the sludge holding tank. The waste sludge is then removed and transported to a waste processing plant. All sludges are tested for radiological contaminants prior to shipping. If any radionuclides are detected, the waste is deemed radioactive and disposed of as low level radioactive waste.

The liquid portion of the waste stream flows into a secondary clarifier which further settles out the remaining suspended particles. The effluent of the secondary chamber then flows into a chlorine contact chamber where any remaining microorganisms are dosed with a specified concentration of chlorine. The effluent is allowed to remain in the chlorine contact chamber for a set period which allows time for the chlorine to effectively kill any pathogenic organisms. The effluent flows into a dechlorination chamber. This step removes any residual chlorine which would be toxic to organisms in downstream environments. From the dechlorination chamber, the final effluent, which at this stage is basically water, is gravity fed to the main discharge pipe and released to the Chesapeake Bay.

Based on the above, impacts of chemicals in thoroughly treated, permitted WWTP effluents to the water quality of the Chesapeake Bay will be negligible and are not expected to warrant additional mitigation.

6.4.3.4 Desalination Impacts

Brackish wastewater from the Desalination Plant will be treated prior to release to the Chesapeake Bay by mixing with site process waters to reduce the salt and metal concentration to match the ambient Chesapeake Bay water conditions. Brackish process wastewater may contain all or some of the following constituents: high salt concentrations, chemicals used during defouling of plant equipment and pretreatment, and toxic metals (which are most likely to be present if the discharge water was in contact with metallic materials used in fabrication of the plant facilities). Liquid Desalination Plant wastes will be discharged to a retention basin before being returned to the Chesapeake Bay.

An RO desalination system will be utilized. In an RO plant, water is pumped at high pressures through membranes to filter out dissolved particles. The Desalination Plant will be located adjacent to the cooling tower for the CWS. The Desalination Plant will withdraw Chesapeake Bay water from the CWS makeup line. The Desalination Plant feed water will be pretreated to protect the membranes of the RO process.

Pretreatment equipment includes holding tanks, strainers, a series of sand filters, coagulation tanks, and an ultraviolet sanitation system. The pretreatment system is periodically backwashed, and the small amount of backwash is combined with a large dilution volume of cooling tower blowdown before it is discharged into the Chesapeake Bay through a series of diffusers.

Under normal operation, the product water requirement for the Desalination Plant is 3,040 gpm (11,508 lpm). The Desalination Plant will be able to recover up to 50% of the input Bay water as fresh water, and will produce a wastewater stream with a salt concentration that is up to twice the ambient Chesapeake Bay concentration. This is similar to the concentration of the cooling tower blowdown. During plant shutdown conditions, salt concentration will be managed to remain within discharge limits.

Desalination plant effluent will be only a small fraction of the total blowdown flow. Approximately 18,295 gpm (69,254 lpm) of blowdown will be returned to the Chesapeake Bay from the CWS and ESWS cooling towers, which is equivalent to 40.8 ft3/s (1.2 m3/s). The Desalination Plant wastewater and waste treatment system effluent produces only a slightly higher total discharge flow of approximately 19,425 gpm (73,531 lpm) or 43.2 ft3/s (1.2 m3/s). The combined Bay discharge flow from the CWS blowdown and the Desalination Plant effluent is insignificant, even when the Chesapeake Bay is in low flow condition (30,800 ft3/s (872 m3/s)).

6.4.3.5 Sanitary Sewage Impacts

A sanitary WWTP will collect sanitary wastes. It will be designed for domestic waste only and exclude industrial materials, such as chemical laboratory wastes, and will be sized to accommodate the needs of personnel associated with the unit. The WWTP system will be monitored and controlled by trained operators.

The CCNPP Unit 3 WWTP's system capacity and unit loading factors are provided in Table 6.4-3. The CCNPP Unit 3 WWTP is expected to treat sanitary waste the same as other WWTPs in Maryland and meet similar limitations. CCNPP Unit 3 discharge will be combined with other waste streams and discharged to the Chesapeake Bay pursuant to the NPDES permit.

Table 6.4-4 lists anticipated CCNPP Unit 3 effluent concentrations associated with the WWTP. It includes flow rates, pollutant concentrations, and the biochemical oxygen demand at the point of discharge. The effluent discharge rates from the WWTP are expected to be similar to those achieved by the WWTP for Units 1 and 2.

Table 6.4-3 CCNPP Unit 3 Waste Water Treatment Plant (WWTP) Capacity and Unit Loading

Average Daily Flows	2
Number of people during normal operation	363/day
Flow assumption	30 gpd (132.5 lpd)/person/shift
Shifts per day	3
Peak flow during outages (times daily average flow)	3
Mass BOD and TSS per person	0.055 lb (0.25 kg)/day/person
Minimum number of people using shower facilities during normal operation	250/day/shift
Construction phase staffing	4,000/day/shift
Design flow-normal operation	52,500 gpd (1.98 E+5 lpd)
Design flow-outages (peak)	183,000 gpd (6.93 E+5 lpd)
Design flow-construction CCNPP Unit 3	250,000 gpd (9.46 E+5 lpd)
BOD/TSS (estimated)	
Normal plant operations	125 lbs (56.7 kg)/day
Outages	375 lbs (170 kg)/day
CCNPP Unit 3 construction	400 lbs (181.4 kg)/day

TSS = Total Suspended Solids
BOD = Biochemical Oxygen Demand

Table 6.4-4 Waste Water Treatment Plant (WWTP) System Effluents[1]

Parameter	Concentrations	
	Daily Maximum	Monthly Average
Biochemical Oxygen Demand (BOD)		10.6 mg/l
Chemical Oxygen Demand	26 mg/l	
Total Organic Carbon	5.6 mg/l	
Total Suspended Solids		3.4 mg/l
pH	6.3-8.6	
Ammonia	<1.0 mg/l	
Flow		19,500 gpd (73,800 lpd)
Arsenic	0.014 mg/l	
Chromium	0.041 mg/l	
Copper	0.022 mg/l	
Nickel	0.028 mg/l	
Zinc	0.060 mg/l	
Total Residual Chlorine	<0.1 mg/l	
Fecal Coliform	12 mg/l	

1 The indicated parameters and concentrations for Unit's waste water treatment plant (WWTP) are based on effluent for the CCNPP Units 1 and 2 WWTP. Effluent characteristics for the CCNPP Unit 3 WWTP are anticipated to be similar.

6.4.3.6 Thermal Impacts

The CCNPP Unit 3 will discharge through a multi-port diffuser system designed to minimize the potential impact of the thermal plume as it enters the Chesapeake Bay. The subsurface diffusers create rapid mixing of the thermal effluent with ambient tidal flows. Strong tidal currents driven by the rise and fall of tides in the Chesapeake Bay largely determine plume size and shape. The NPDES permit will limit the thermal discharges in accordance with State requirements (COMAR 26.08.03.03). These water quality regulations limit the spatial extent of thermal plumes:

- The 24-hour average of the maximum radial dimension measured from the point of discharge to the boundary of the full capacity 2ºC (3.6ºF) above ambient isotherm (measured during the critical periods) may not exceed 1/2 of the average ebb tidal excursion.

- The 24-hour average full capacity 2ºC (3.6ºF) above ambient thermal barrier (measured during the critical periods) may not exceed 50 percent of the accessible cross section of the receiving water body. Both cross sections shall be taken in the same plane.

- The 24-hour average area of the bottom touched by waters heated 3.6ºF (2ºC) or more above ambient at full capacity (measured during the critical periods) may not exceed 5 percent of the bottom beneath the average ebb tidal excursion multiplied by the width of the receiving water body.

Alternate, less stringent criteria can be established on a case-by-case basis if it can be demonstrated that the thermal discharge criteria are more stringent than necessary to assure the protection and propagation of a balanced, indigenous community of shellfish, fish, and wildlife in and on the body of water into which the discharge is made.

General temperature requirements for Maryland Class II waters such as the Chesapeake Bay also include a limit on maximum water temperature and zone of passage outside the mixing zone (COMAR 26.08.02.03):

- Water temperatures may not exceed 90ºF (32ºC) or the ambient temperature of surface waters,

- A thermal barrier that adversely affects aquatic life may not be established, and

- Discharge of chlorine from the cooling tower blowdown is limited to 0.2 mg/l monthly average and 0.5 mg/l daily maximum of free available chlorine as determined using the amperometric titration method.

<u>Thermal Plume Model</u>

The spatial configuration of the CCNPP Unit 3 thermal plume was simulated using the Cornell Mixing Zone Expert System (CORMIX). CORMIX is a U.S. EPA supported mathematical modeling tool for the analysis, prediction, and design of aqueous toxic or conventional pollutant discharges into diverse water bodies. The model can be used for environmental impact assessment of regulatory mixing zones resulting from continuous point source discharges such as CCNPP Unit 3. The model accounts for the effects of boundary interactions, and predicts steady-state mixing behavior and plume geometry. The CORMIX methodology contains different options used to model single-port, multi-port diffuser discharges, and surface discharge sources. Effluents considered may be conservative, non-conservative, heated, or brine discharges.

Input parameters used in the CCNPP Units 3 CORMIX thermal plume simulation are given in Table 6.4-5 and Table 6.4-6. Results are provided in Table 6.4-7 and Figure 6.4-1. The 3.6ºF (2ºC) isotherm extends approximately 207 ft (63 m) beyond the discharge multi-port diffusers on the ebb and flood tides. The slack tide 3.6ºF (2ºC) isotherm is predicted to extend less than 20 ft (6.6 m) beyond the diffusers. The modeled plume predictions are considered conservative since the CORMIX model constrains the depth of the plume to no more than 30 percent greater than the depth at discharge, or -13 ft (-4.0 m) in this case. Furthermore, a sensitivity analysis comparing plume size at differential water temperatures below 12ºF (6.7ºC) demonstrated that plume size decreases as delta-T is reduced.

The area occupied by the plume is compared to the State of Maryland water quality criteria in Table 6.4-8. This comparison demonstrates that the CCNPP Unit 3 thermal plume conforms to each of the criteria. The radial dimension of the 3.6ºF (2ºC) isotherm is less than 3% of the ebb tide excursion, as compared to the less than one-half (50%) ebb tide excursion specified by Maryland regulation. The full capacity of the 3.6ºF (2ºC) isotherm is less than 0.3% of the Chesapeake Bay cross section, and the bottom area affected by the plume is about 0.01% of the average ebb tidal excursion multiplied by the width of the Chesapeake Bay.

6.4.3.7 Site Surface Water Impacts

Site surface water bodies potentially impacted by site operations are dependent upon operational conditions related to site safety and spill containment training, a spill pollution prevention control and counter-measure plan (SPCC), and a stormwater pollution prevention plan (SWPPP).

Spills or operational debris potentially occurring on outdoor facilities could mix with site precipitation or washing wastewater and be conveyed to downstream impoundments, creeks, rivers, and eventually the Chesapeake Bay. The majority of polluted runoff can be controlled and prevented from escaping the CCNPP site. Environmental impacts on water quality during operation of CCNPP Unit 3 are expected to be minimal. Surface water runoff and sedimentation effects will be minimized by implementation of a site safety and spill prevention plan and an SWPPP. Effluent from the planned wastewater treatment plant will meet all applicable health standards, regulations, and total maximum daily loads (TMDL) as set by MDE and the U.S. EPA.

6.4.4 Application for Water Use and Appropriation

Included in the appendices is an application package for water use and appropriation permit as required by COMAR 26.17.06 for CCNPP Unit 3 operation.

Table 6.4-5 CORMIX Thermal Plume Simulation Receiving Water Baseline Input Parameters

Input Quantity/Data	Parameter Value
Bathymetry Surrounding Project Site	NOAA Navigational Chart
Minimum Water Surface Elevation at Discharge Location	-10 ft = MSL – 0.6 ft (MLW -3.05 m)
Tidal Excursion	Mean Range = 1 ft (0.305 m) Spring Range = 1.1 ft (0.335 m)
Maximum Ebb and Flow Tidal Velocities	1 ft/s (0.305 m/s)
Receiving Water Temperature(s)	Average annual Temperature 57.5ºF (14.3ºC)
Average Wind Speed	3.28 ft/s (1.00 m/s)
Average **(?)** Salinity	13.0%
Receiving Water Density 57.5ºF (14.3ºC), 13.0%	63.004 lb/ft3 (1009.22 kg/m3)

MLW – mean low water
MSL – mean sea level

Table 6.4-6 Baseline Discharge Structure Input Data CORMIX Thermal Plume Prediction

Input Quantity/Data	Parameter Value
Location	1,200 ft (366 m) south of the CCNPP Unit 3 intake structure
Discharge Water Temperature ΔT	12ºF (6.67ºC)
Discharge Water Density (69.5ºF, 13.0%)	62.919 lbm/ft3 (1007.87 kg/m3)
Discharge Flow Rate	17,633 gpm (1.1125 m3/s)
Diffuser Type	Multi-port
Number of Discharge Ports	3
Distance from Shore	550 ft (167.6 m)
Orientation	Parallel to Shoreline
Height of Discharge Ports above Bottom	3 ft (0.91 m)
Angle of Inclination	22.5 degrees
Nozzle Diameters	16 in (0.406 m)
Active Diffuser Length	18.75 ft (5.715 m)

Table 6.4-7 CORMIX Thermal Plume Predictions for the 3.6ºF (2ºC) Isotherm

Plume No.	Description	Length	Width
1	Max. Ebb	207 ft (63 m)	59 ft (18 m)
2	Max. Flood	207 ft (63 m)	59 ft (18 m)
3	Slack	19 ft (6 m)	6 ft (2 m)
4	Mid. Ebb (before and after slack)	105 ft (32 m)	43 ft (13 m)
5	Mid. Flood (before and after slack)	105 ft (32 m)	43 ft (13 m)
Overall	Thermal Plume Envelope	414 ft (126 m)	69 ft (21 m)

Table 6.4-8 Comparison of the Predicted Thermal Plume to the Maryland Power Plant Thermal Plume Compliance Criteria

Water Quality Standard	Permissible Limit	Calculated
The 24-hour average of the maximum radial dimension measured from the point of discharge to the boundary of the full capacity 2ºC[3.6ºF] above ambient isotherm (measured during the critical periods) may not exceed 1/2 of the average ebb tidal excursion.	4,101 ft (1250 m)	< 207 ft (63 m)
The 24-hour average full capacity 2ºC[3.6ºF] above ambient thermal barrier (measured during the critical periods) may not exceed 50 percent of the accessible cross section of the receiving water body. Both cross sections shall be taken in the same plane.	16,000 ft (4,800 m)	69 ft (21 m)
The 24-hour average area of the bottom touched by waters heated 2ºC[3.6ºF] or more above ambient at full capacity (measured during the critical periods) may not exceed 5% of the bottom beneath the average ebb tidal excursion multiplied by the width of the receiving water body.	1.3E07 ft2 (1.2E06 m2)	2.9E04 ft2 (2.7E03 m2)

6.5 AIR QUALITY IMPACTS OF OPERATIONS

The air emissions sources associated with the operation of CCNPP Unit 3 include the cooling tower for the cooling water system (CWS), four Essential Service Water System (ESWS) cooling towers, and six standby diesel generators. The CWS cooling tower will be a source of particulate matter as a result of cooling tower "drift", i.e., the release of impurities, largely salt, in the water entrained in the air stream and carried out in the cooling tower plume. This is the largest source of emissions at the facility. The diesel generators will emit pollutants from fuel combustion when operating. All air emission sources will be managed in accordance with federal, state, and local air quality control laws and regulations

There are four steam generators that feed high pressure steam to a manifold and subsequently to the turbine generator. After the steam passes through the turbine it is cooled in the main condenser. The main condenser has three sections, one each for high pressure, medium pressure and low pressure steam. Chilled water from the CWS (about 85º to 90ºF) is used to cool the steam to water before being pumped back to the steam generator. The CWS supplies about 790,000 gallons per minute to the main condensor. The cooling towers transfer waste heat contained in the CWS cooling water through direct contact with an air stream.

The CWS cooling tower design is based on an air flow rate of 66 million acfm and a water circulation rate of 777,560 gallons per minute, with makeup water drawn from the Chesapeake Bay to offset evaporation, drift, and blowdown. The CWS cooling tower will operate continuously. The four smaller ESWS cooling towers are each designed for an air flow rate of 1.3 million scfm and 18,333 gallons per minute relying on water generated by the Desalination Plant. Only two ESWS units will typically be in service during normal operating conditions.

Emergency power will be provided by four 10,130 kWe horsepower emergency diesel generators (EDGs) and two 5,000 kWe diesel Station Black Out Generators (SBOs). Diesel fuel will be stored in tanks, which are considered negligible sources of air emissions.

6.5.1 Federal and State Regulations

EPA has established National Ambient Air Quality Standards (NAAQSs) for carbon monoxide, nitrogen oxide, ozone, particulate matter, sulfur oxides, and lead. These ambient standards have been adopted by Maryland (COMAR 26.11.02). Federal and state regulations require the permitting of new and modified sources of air pollution and set limits on the emissions from certain source operations to provide for attainment and maintenance of the NAAQSs.

New or modified sources of air emissions must file a permit application to the State of Maryland prior to construction to obtain authorization to construct. These permit applications are reviewed and permit conditions are proposed by PPRP/MDE. The Commission holds public and adjudicatory hearings and, upon issuance, the CPCN constitutes authorization to construct. The Commission incorporates appropriate conditions as part of the CPCN, which may limit emissions, restrict operating practices, and require monitoring, recordkeeping, testing and reporting. The requirements in a construction permit provide the basis for issuing an operating permit. Under the federal Clean Air Act, these requirements are enforceable by MDE and EPA. As stated above, the air permit must be obtained prior to commencing any on-site construction activities.

The specific requirements that must be addressed to obtain a construction permit depend on the air quality status for the geographic area where the source will be located, the source category, and the magnitude of emissions or potential-to-emit (PTE) qualifying a source as a minor or major source of emissions. The air quality status is based on monitoring data, and whether the area's air quality is equal to or better than the

NAAQS for each criteria pollutant. Calvert County has been designated an area with air quality that is in attainment with the NAAQS for carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2) and particulate matter less than 10 microns (PM10) and particulate matter less than 2.5 micron ($PM_{2.5}$). For ozone, however, Calvert County is designated as part of the Mid-Atlantic "transport region" and considered nonattainment. Volatile organic compound (VOC) and nitrogen oxide (NOx) emissions, precursors to ozone formation in the atmosphere, are regulated based on the ozone nonattainment designation.

The type of air permit that is needed also depends on the magnitude of air emission increases requested by an applicant. Because there are existing sources of air pollution at the facility that support Units 1 and 2, any increases in air emissions would be considered a modification to an existing source. Specific trigger levels have been established which define whether such increases in air emissions would be considered major source or a minor source modification. More stringent permitting requirements apply to major sources than to minor sources. The definition of major and minor source depends on the pollutant and the present air quality levels in the area. The definition for major is different for nonattainment areas than for attainment areas. For example, the Unit 3 modification is considered a minor source of nitrogen oxides emissions because it is located in an area attaining the nitrogen dioxide air quality standard. Thus the trigger level for a major modification would be 250 tons per year. However, nitrogen oxide emissions from the Unit 3 modification must also be considered relative to their importance in an ozone nonattainment area because nitrogen oxides are precursors to ozone formation. Calvert County is a non-attainment area for ozone. The trigger level for ozone (nitrogen oxide emissions) is 25 tons per year. In sum, because the Unit 3 potential emissions are less than 25 tons per year, the modification is defined as a minor source for the attainment pollutant NOx and, at the same time, defined as a minor source of NOx for the pollutant ozone.

In attainment areas, major new and modified sources are subject to the Prevention of Significant Deterioration (PSD) requirements. The major source threshold for PSD applicability is 100 tons per year PTE for a list of 28 source categories, and 250 tons per year PTE for all other sources. The existing CCNPP Units 1 and 2 have fossil fuel fired auxiliary boilers that have a combined nameplate heat input rate that is greater than 250 MMBTU/hr. Although the CCNPP boilers are rarely needed at the facility, they could qualify as a source that is listed as one of the 28 special categories in the PSD program. Thus, the existing operations would be minor according to the PSD definitions if the potential or allowable emissions are under 100 tons per year.

Major sources located in nonattainment areas are subject to the most stringent permitting requirements including application of control technology representative of the lowest achievable emission rate (LAER) and obtaining additional emission reductions to more than offset potential impacts. In Calvert County the major source threshold for NOx and VOCs is 25 tons per year of either pollutant.

Other toxic air pollutants are also subject to regulation. The toxic pollutants from Unit 3 are largely due to the chemicals used in the cooling water to prevent biological build-up and scaling of the pumps, spray heads, pipes, etc. For a list of 189 designated hazardous air pollutants (HAPs) EPA has established by source category National Emission Standard for Hazardous Air Pollutants (NESHAPs) that apply to major sources of HAPs. Maryland also regulates sources of "toxic air pollutants" (TAPs) and requires the application of best available control technology (T-BACT) to sources with TAP emissions exceeding thresholds calculated for each substance as a function of American Council of Governmental and Industrial Hygienists (ACGIH) threshold-limit-values (COMAR 26.11.15). The cooling towers and generators do not contribute significant quantities of HAPs or TAPs, however, the substances emitted from Unit 3 must be included in the state air permitting analysis.

The air quality impacts, i.e., the expected concentrations of the air pollutants released from the cooling towers and diesels from the operation of Unit 3 at ground level are small. However, the Co-Applicants have included a more detailed analysis of the best available control technology (BACT) and an air quality impact analysis for the sources of air pollution expected during the future operation of CCNPP Unit 3.

6.5.1.1 New Source Permits and NAAQS Compliance

The existing Calvert Cliffs Nuclear Power Plant (CCNPP) has an air construction permit for some of their support equipment and a Part 70 (Title V) Operating Permit. CCNPP Unit 3 will be co-located with the existing Units 1 and 2, will have the same major SIC code, and may be determined to be under common control or persons under common control, COMAR 26.11.02.01C(1), as CCNPP Units 1 and 2. Because of the common ownership, the new Unit 3 expansion will be considered a modification to an existing facility/source.

The sources of air emission comprising CCNPP Units 1 and 2 consist of two auxiliary boilers with a combined heat input rate of 328 MMBTU/hr that are used to provide steam when both reactors are simultaneously shut down and seven emergency diesel generators that are used in the event that both reactors are down and outside power cannot be obtained from the grid. Over the past 30+ years of operation, there has been virtually no need to operate any of the emergency equipment. Generally, the emergency equipment is tested and run on a scheduled basis to assure compliance with NRC requirements.

The maximum calculated emissions which were summarized by the Maryland Department of Environment (MDE) in the Part 70 (Title V) Operating Permit Fact Sheet are shown in Table 6.5-1. There were no federally enforceable mass emission limits identified or included by the MDE in the Operating Permit for Units 1 and 2. CCNPP Units 1 and 2 actual emission levels (for the past two years which are consistent with all prior years of operation) are also summarized in Table 6.5-1. As the table demonstrates, the actual emissions for this facility are a fraction of the maximum calculated emissions. These actual emissions primarily represent periods when the emergency equipment is being tested to assure readiness in the event of an emergency.

Table 6.5-1 Maximum Calculated and Actual Emissions for Existing Units No. 1 and No. 2 Operations (Annual tpy)

	Particulate matter (PM/PM10)	Nitrogen Oxides (NOx)	Carbon Monoxide (CO)	Volatile Organic Compounds (VOCs)	Sulfur Dioxide (SO2)
Maximum Calculated Emissions for Units 1 and 2	164	1,917	486	46	1925
Average Actual Emissions for Units 1 and 2 (Based on 2005 & 2006)	2.5	10.5	2.8	0.3	0.1

The maximum calculated emission levels for Units 1 and 2 do not represent the "potential to emit" for this facility, nor are they federally enforceable limits. The current potential to emit for the existing emergency equipment, which is needed to evaluate the type of air construction permit needed, is calculated following the appropriate September 6, 1995 guidance from EPA's John Seitz, Director of Air Programs wherein it is recommended that "a reasonable and realistic 'worst case' estimate" be used to calculate the potential to emit. The realistic worst case emissions estimate, based on 30+ years of historical data and multiplying by a factor of 10, show that the maximum emission level for any pollutant is less than 100 tpy. These worst case calculations are based on 1,400 hours of operation per year for the boilers, 1,000 hours per year operation for the three older diesel generators and keeping the recently permitted 800 hours of operation for the four newer diesel generators.

Based upon the NRC and manufacturer's performance testing requirements and historical equipment usage, the Co-Applicants are prepared to ask that the emissions from CCNPP Units 1 and 2 be more precisely defined, either in terms of hours of operation or fuel usage rates, to be more consistent with the actual usage and emission rates. The lower emission rates will be less than 100 tpy. Thus the facility will be a minor source for PSD permitting purposes. Furthermore, the two existing auxiliary fossil fuel boilers have a "combination thereof" heat input rate greater than 250 MMBTU/hr. However, they are not among the 28 special source categories subject to a 100 tpy threshold for PSD applicability when applying "reasonable worst case" assumptions because the PTE for the facility is under 100 tpy. As such for PSD permitting purposes, the existing Units 1 and 2 are an existing minor source of air emissions.

Using the Seitz guidance, the facility (the Units 1 and 2 emergency support equipment) is a major source of NOx emissions for the ozone non-attainment area because the PTE for NOx is greater than 25 tons per year. This major source status will be used to evaluate the permitting needed for the Unit 3 modification under the EPA's New Source Review (NSR) permitting program for the nonattainment area.

EPA has established a methodology for estimating emissions from cooling towers based on the water recirculation rate, the dissolved solids content in the water, the "cycles of concentration ratio" between makeup water and the blow down rate, and the towers "drift" rate, i.e., the percent of circulating water that becomes entrained in the vented air stream (AP-42, Section 13.4 Wet Cooling Towers, 1/1995). Modern cooling tower designs include high efficiency drift eliminators to minimize water losses. Drift rates for new cooling towers are reported in the 0.001% to 0.0005% range. Methodologies for computing the fraction of the particles in the water droplets that are 10 microns and below have recently been published ("Calculating Realistic PM10 Emissions from Cooling Towers", Reisman, J. and G. Frisbie, *Environmental Progress*, Vol. 21, No. 2, July 2002). This methodology was used to estimate the fraction of PM that is PM10 for calculating the Unit 3 emissions.

Potential emissions from the Unit 3 addition are summarized in Table 6.5-2.

Table 6.5-2 Potential Emission Estimates for Unit 3

Source	PM	PM10	NOx	CO	VOC	SO2
Maximum Expected Emissions During Plant Operation (tons per year)						
Cooling Water System Cooling Tower (1 tower)	238.6	190.9				
Essential Service Water System Cooling Towers (4 towers)	3.1	2.9				
Diesel Generators (6 units)	1.6	1.6	22.8	29.0	4.1	0.4
Total	**243.3**	**195.4**	**22.8**	**29.0**	**4.1**	**0.4**

The emissions represent a minor modification to what will be an existing minor source. The Prevention of Significant Deterioration (PSD) permit will not be required for this facility modification involving Unit 3 because the potential emissions for any pollutant are less than 250 tpy. Neither will it be necessary to obtain a major new source review (NSR) permit for the transport nonattainment area, because the emissions of NOx are below the 25 tpy trigger level.

The new generators will be small sources of NOx and CO, but will qualify for permitting as a minor source for these two pollutants with the PTE estimated at less than 25 tons per year for each of the nonattainment pollutants. They will also qualify for permitting as a minor source and not subject to PSD for the attainment pollutants (VOC, PM and SO2). The diesel fuel storage tanks serving these generators are exempt from new source permitting requirements.

The new cooling towers will be significant sources of PM and PM10 emissions. The estimated allowable PM emissions for the cooling towers is less than 250 tons per year of PM and PM10 emissions, also qualifying the cooling towers to be permitted as a minor source, i.e., also not subject to PSD. There are no other quantifiable criteria pollutants emitted from the cooling tower.

Based on combined PTE emission estimates for the cooling towers and the emergency generators, a minor new source permit application is required for these sources. Sources that qualify for minor source permits, as minor sources, are considered to have a negligible impact on ambient air quality. Their nonattainment pollutant emissions are minor and accommodated by the State's plan for providing attainment. In attainment areas where PSD applies, a minor source's expected impact does not appreciably consume any of the allowable incremental decrease in air quality allowed by the PSD regulations. In sum, by qualifying as a minor source, the proposed addition of the CCNPP Unit 3 will not jeopardize the compliance with the NAAQSs in Calvert County.

6.5.1.2 Applicable Emission Standards

Although the analysis of the best available control technology is not mandated for minor sources, Co-Applicants discuss below the options considered in selecting the mist elimination system for the largest source of PM and PM10 emissions. Subsequently, we will review the applicable emission regulations for all sources.

Best Available Control Technology (BACT) Analysis for CWS Cooling Tower

Figure 6.5-1 is a schematic of the large cooling tower and shows the amounts of water that are needed to reject heat from the steam turbines. The maximum expected annual concentration ever anticipated of the inlet water is 17,500 ppm of total dissolved solids. Some of these solids will be discharged into the air because the solid material will be dissolved in the tiny water droplets that emitted from the tower. The tiny water droplets are formed because of the mechanical energy used to spray water within the cooling tower which increases the surface area of the water which is used to reject heat through evaporation. Evaporated water is a gas (H2O), like the water associated with the humidity in the air, and does not contain any particles. Some droplets do not evaporate completely and are discharged through the top of the tower and contain dissolved particles. After the droplet leaves the tower, the water evaporates leaving the particle. This is the source of the particulate emission that must be considered in order to maintain air quality standards.

The industry norm for minimizing both the water discharge from the tower and the particulate discharge is to use drift eliminators. These drift eliminators are a series of shaped surfaces such as a chevron that are designed so that the water plume will come into contact with the surface through inertial impaction. The shape of the fin or chevron, as well as the spacing, will each effect the capture/removal of the droplets and therefore the particulate matter. The greater contact area will result in greater impaction and therefore, greater removal of the water droplets.

An investigation was conducted of the options that would be available to the CCNPP Unit 3 cooling tower. Table 6.5-3 summarizes the level of control achieved by the drift eliminators. The efficiency is commonly expressed as a percent of the recirculated water in the tower. In the case of Unit 3 the amount of recirculated water is 777,560 gpm. Typical drift eliminators will have removal values at 0.005 to 0.0005%. For Unit 3 this would result in 39 of the 777,560 gallons of water being discharged each minute for the 0.005% eliminator to as little as 3.9 gpm for the 0.0005% eliminator. The measurement of these quantities of water droplets formed when compared to the total amount of water used in the towers can be difficult.

It is not known whether the level of control achieved by the facilities identified in Table 6.5-3 could also be achieved for the Unit 3 CWS cooling tower. There are many factors that are used in assessing the technical feasibility of high efficiency drift eliminators. The table clearly illustrates that the levels being contemplated by the Co-Applicants are practical and that they are in the range that other regulators have deemed to be the best available control technology for those sources.

There are several publications including EPA data which show that the drift eliminators can achieve from virtually 0.0% (<0.0001%) to 0.005% on different cooling towers. The amount of recirculating water in the tower has a pronounced effect on the efficiency of the drift eliminators. Smaller units tend to achieve a better efficiency.

Table 6.5-3 Summary of Recent BACT Determinations for Cooling Towers

Facility, Location	Cooling Tower Throughput Rate	PM10 Emission Limit (lb/hr)	Control Option
Sempra Energy – Catoctin Plant, Frederick Co., Maryland	187,400 gpm	0.73	0.0005% high efficiency drift eliminators
Diamond Wanapa I LP, Umatilla County, Oregon			0.0005% high efficiency drift eliminators
Newmount Nevada Energy, Eureka Co., Nevada			0.0005% high efficiency drift eliminators
Public Service Co, Pueblo Co., Colorado	140,650 gpm		0.0005% high efficiency drift eliminators
Omaha Public Power, Otoe County, Nebraska		0.001	0.0005% high efficiency drift eliminators
Wallula Power, Washington		3.7	0.0005% high efficiency drift eliminators
Auburn Nugget, DeKalb Co., Georgia	23,450 gpm		0.005% high efficiency drift eliminators

The Co-Applicants have contacted several vendors who have provided information on their cooling towers and the drift eliminators that could be used. SPX Cooling Technologies have provided information that support a drift efficiency of 0.0005%. SPX has further indicated that they could design a system to achieve 0.0004%.

This removal efficiency is equal to or greater than the other cooling towers of similar size that have recently been permitted through the PSD process. The Co-Applicants have concluded that the chevron drift eliminator designed by SPX represents the best available control technology for the CWS cooling tower. Emissions will be controlled to the design specification of 0.0004% of the recirculated water rate.

Maryland Cooling Tower Regulations

The cooling towers are a source of particulate emissions (PM) and must comply with a total particulate matter (PM) limitation in COMAR Regulation 26.11.06.03B(a). Sources installed in Calvert County, which has an “Area V” designation, must meet a PM emission limit of 0.05 grains per dry standard cubic foot of exhaust air. This regulation was developed for industrial sources of dust. Although it could technically apply to cooling towers, the Unit 3 cooling towers without any drift eliminators (uncontrolled) would never approach the allowed level of emissions from this regulation, i.e., the allowable PM emissions are 24,604 lb/hr and there is only 54.5 lb/hr of PM in all of the water droplets that could pass through the drift eliminators.

Industrial process cooling towers are also subject to a National Emission Standard for Hazardous Air Pollutants (NESHAP, 40 CFR part 63, Subpart Q). The cooling tower NESHAP prohibits the operation of cooling towers using chromium compounds in water treatment chemicals at major sources of hazardous air pollutants (HAPs). Because CCNPP Unit 3 is not a major source of HAPs this NESHAP standard does not apply. The use of chromium-based biocides in the cooling towers is not planned.

Estimated Emissions

To estimate the PTE for PM10 and to demonstrate compliance with the PM emission limit for the cooling towers, worst-case assumptions were assumed for the cooling tower drift rate, total dissolved solids, and the fraction of drift that is PM10. The same parameters were used for the CWS and the ESWS towers, although the total dissolved solids in the ESWS units would be considerably lower based on use of desalinated water. All units were assumed operate 8,760 hours a year to estimate PTE. The expected operation of the four ESWS units is the equivalent of two of the four units operating year round. Thus, the PTE estimates are overestimates of actual emissions.

The emission estimates are presented in Table 6.5-2 and 6.5-4. The estimated PM emissions are well below the allowable limit for both cooling towers and diesel generators, total PM emissions are estimated at 242 tpy. The worst-case PM10 PTE estimate is 194 tons per year, less than the 250 ton per year major source threshold. Additionally the PM2.5 emissions are 32 tons per year.

Table 6.5-4 Potential Emission Estimates for CWS and ESWS Cooling Towers

Parameter	Units	CWS	ESWS
Number of Units		1	4
Design Air Flow Rate	cfm	66,454,900	1,213,000 each
Design Water Flow Rate	gpm	777,560	9,538 each
Water Source		Chesapeake Bay	Desalinization Plant
MDE PM Emission Limit	Grains/dscf	0.05	0.05
	Equivalent allowable lbs/hour	27,604	539 each
Cooling Tower Drift Rate	% of Circulating Water	0.0004	0.005
Total Dissolved Solids	ppm	17,500	372
Cycles of Concentration Ratio (Tower/Makeup Water)	Ratio	2	2
Estimated Worst-Case PM Emission Rate	Tons/year	238.6	3.1 all four
Drift Fraction as PM10	Fraction	0.80	.93
Drift Fraction as PM2.5	Fraction	0.13	.16
Estimated PM10 Emissions (PTE)	Lbs/hour	44	.7 all four
	Lbs/day	1056	15.9 all four
	Tons/year	190.9	2.9 all four
	Tons/year All Units	193.8	
Estimated PM2.5Emissions (PTE)	Lbs/hour	7.1	0.1 all four
	Lbs/day	170	2.7 all four
	Tons/year	31.0	0.5 all four
	Tons/year All Units	31.5	

Cooling Tower Toxic Air Pollutant Analysis

Maryland regulates air emissions of individual chemical substances that qualify as "toxic air pollutants" or TAPs (26 COMAR 11.15 and 11.16). Class I TAPs are known or potential carcinogens specifically identified in 26 COMAR 11.16.06. Class II TAPs include all other chemical compounds that have other potential acute or chronic health effects including those regulated by OSHA. The TAP regulations include provisions for exempting sources with low levels of TAP emissions and, for non-exempt sources, calculating screening values for mass emission rates (i.e., lbs per hour or lbs per year) and ambient air concentration levels (i.e., ground-level air quality in micrograms per cubic meter). If screening levels are exceeded, then more extensive atmospheric dispersion modeling is required. If estimated emission rates and ambient concentrations are less than screening values, no further ambient impact analysis of TAPs is required. Sources subject to preconstruction review for TAP emissions must demonstrate the use of best available control technology for TAPs (T-BACT). The TAP requirements do not apply to fuel combustion sources (26 COMAR 11.15.03B(2)(a)).

The cooling towers are the only source of TAP emissions. Tower operation requires the use of chemical additives to the cooling water to prevent biological growth and scale build-up that would reduce heat transfer and cooling tower performance. Table 6.4-2 lists chemical additives and the estimated quantities of each of the materials expected to be used in the operation of CCNPP Unit 3, including those used by the cooling towers. These chemicals will be added to the cooling tower makeup water or to the blowdown at varying concentration levels. The cooling tower drift will contain the chemicals added to the makeup water at the same concentrations they were added, and as such, will be a source of TAP emissions. Chemicals added to the blowdown only (i.e., sodium bisulfite), will not be released in the drift. The chemicals released with the drift that are subject to TAP review include sodium hypochlorite, sodium hydroxide, a constituent in the dispersant (1-hydroxy-1,1-diphosphonoethane or HEDP), and a constituent in the antifoaming agent (petroleum distillates). Appendix C includes the completed MDE Form 5A required for the review of TAPs.

The emission rate for each TAP was estimated based on the drift loss rate, the same approach used for the PM and PM10 emission estimates from the cooling towers. The concentration in the drift was estimated based on the expected chemical use rate in the makeup water. The screening values were taken from MDE's April 2007 Screening Level Listing, with the exception of HEDP. The HEDP screening value was calculated based on animal study data from the MSDS for the dispersant as provided for by 26 COMAR 11.16.03A(2)(a)(vi).

The ambient air quality impact for each TAP was determined using the maximum air quality impact estimated for PM10, adjusted by the ratio of TAP to PM10 emission rates. One-hour and 8-hour concentrations were estimated based on applying EPA averaging period factors taken from "Screening Procedures for Estimating the Air Quality Impact of Stationary Sources" (EPA-454/R-92-019, October 1992). The screening values, estimated emission rates, and estimated ambient impacts for the CWS cooling tower are shown in Table 6.5-5. Based on the material usage rates for the ESWS in Table 6.4-2, emission rates and ambient impacts for sodium hypochlorite, sodium hydroxide, and HEDP from the ESWS would be about two orders of magnitude smaller than those shown in Table 6.5-5 for the CWS cooling tower.

Table 6.5-5 TAP Analysis

Chemical	MDE Screening Value (μg/m³)	Estimated Emission Rate (lbs/hour)	Estimated Maximum Ambient Impact (μg/m³)
Sodium Hypochlorite	81.2 8-hour	0.002	0.0007 8-hour
Sodium Hydroxide	20 1-hour	0.006	0.003 1-hour
HEDP	82 8-hour (based on Oral Rat LD50 >2,000 mg/kg)	0.002	0.0005 8-hour
Petroleum Distillate	170 8-hour	0.003	0.0008 8-hour

The release of TAPs is controlled from the cooling towers by high-efficiency drift eliminators, which represents T-BACT.

Generators

The new generators will be in compliance with the federal Standards of Performance for New Stationary Compression Ignition Internal Combustion Engines (40 CFR Part 60, Subpart IIII). They will exceed the requirements for emergency engines with greater than 30 liter per cylinder displacement (40 CFR 60.4205(d)). The estimated emissions for the new generators are based on emission rate information provided by the engine manufacturer. These emission rates will be achieved through application available diesel control technology at time of installation and are equivalent to the Tier 4 requirements for diesel generators greater than 1,200 horsepower (40 CFR 60.4204). The sulfur content of diesel fuel that will be consumed by the generators will be no more than the 500 ppm allowed for diesel engines with greater than 30 liter cylinders (40 CFR 60.4207(a) and 80.510(a)).

EPA has also established a NESHAP standard that applies to Stationary Reciprocating Internal Combustion Engines located at major sources (40 CFR Part 63, Subpart ZZZZ). The requirements in this rule for emergency generators are limited to notification provisions. Since CCNPP Unit 3 will not be a major source for HAPs this standard will not apply.

Maryland regulations prohibit the burning of distillate fuel oil with greater than 0.3 percent sulfur with an Area V designation including Calvert County (COMAR 26.11.09.07). The federal requirement for burning fuel with 500 ppm sulfur or less at time of installation will be considerably more stringent. Fuel-burning equipment consuming distillate oil are exempt from Maryland particulate limitations for fuel combustion because of low levels of particulate emissions (COMAR 26.11.09.06.A(3)(c)). Maryland regulations do not include a limit on NOx emissions for fuel-equipment that operate less than 500 hours with a capacity factor of less than 15%. Thus, there are no applicable emission regulations for NOx for the Unit 3 generators.

Normal operation of the generators will be limited to periodic testing and maintenance activities to insure readiness and operability. Each EDG unit will be tested for four hours each month, plus an additional 24 to 48 hours of operation once every two years. Each SBO unit will be tested approximately 4 hours every quarter, for an additional 12 hours every year for maintenance, and extended testing for 12 hours every 18 months.

To estimate PTE for these units, the maximum worst-case hours of operation was assumed, 150 hours for each EDG unit and 100 hours for each SBO unit. The generator emission rates and PTE estimates are presented on Table 6.5-6. The estimated PTE for NOx is 22.8 tons/year, less than the 25 tons per year major source threshold that applies in Calvert County. The estimates for PM10 emissions from the generators, which must be considered with the cooling tower emissions, are not significant.

Table 6.5-6 Potential Emission Estimates for EDG and SBO Generators

	One Emergency Diesel Generator (EDG)	One Station Black Out Generator (SBO)	All Generators (4 EDG + 2 SBO)
Engine Size, kWe	10,130	5,000	
Maximum Worst-Case Annual Hours of Operation	150	100	
Criteria Pollutant/Estimated Emissions			
Carbon Monoxide (CO)			
Lbs/hour	78.2	55.1	
Tons/year	5.9	2.8	29.0
Nitrogen Oxides (NOx)			
Lbs/hour	35.7	121.3	
Tons/year	2.7	6.1	22.8
Particulate Matter (PM10)			
Lbs/hour	3.3	5.5	
Tons/year	0.25	0.3	1.6
PM2.5 – (97% PM10, EPA)			
Lbs/hour	3.3	5.5	
Tons/year	0.25	0.3	1.6
Sulfur Oxides (SOx)			
Lbs/hour	1.3	0.02	
Tons/year	0.1	0.001	0.4
Volatile Organic Compounds (VOC)			
Lbs/hour	9.6	12.1	
Tons/year	.7	0.6	4.1

6.5.1.3 Summary of Compliance with Air Regulations

As described above, the CCNPP Unit 3 will operate in full compliance with air pollution control requirements. In summation, this includes:

- National and State Ambient Air Quality Standards – The addition of the new CWS and ESWS cooling towers and the EDG and SBO emergency generators will qualify for permitting as minor sources with no appreciable impact to the current air quality levels or Maryland's plans for providing attainment and maintenance for the NAAQS.

- Federal or State Emission Standards – The new cooling towers will easily comply with the PM emission requirements that apply to process sources. The fuel quality that will be available to the generators at time of installation will exceed the requirements for fuel sulfur content in Maryland regulations. There are no other Maryland emission limits that apply to the fuel combustion by the emergency generators. These sources will be in full compliance with Maryland's federally enforceable emission standards.

- Federal New Source Performance Standards – The emergency generators will be in compliance with the New Source Performance Standard (NSPS) for Stationary Compression Ignition Internal Combustion Engines. No NSPSs apply to cooling towers.

- Federal Emission Standards for Hazardous Air Pollutants – CCNPP is not a major source of HAP emissions, and therefore, is not subject to the MACT standard for cooling towers or the MACT standard for reciprocating internal combustion engines.

- Impact on Prevention of Significant Deterioration Areas and Nonattainment areas – By maintaining minor source status for the attainment pollutants (CO, PM10 and SOx) and the nonattainment pollutants (NOx, VOC), the installation of CCNPP Unit 3 will have an minimal impact on the PSD increments and the Maryland State Implementation Plan (SIP) for attaining the ozone standard.

6.5.2 Air Quality Impacts From Plant Operation

To evaluate the impacts on the surrounding community of the air emissions from CCNPP Unit 3, EPA's AERMOD dispersion model was used along with the estimates of air emissions in Section 6.5.1. The same grid pattern and meteorology used to estimate the air quality impacts due to construction activities were used for this analysis of the future operating scenario with CCNPP Unit 3 in full operation.

Although the emissions of 193.8 tons per year of PM10 are significantly greater than emissions during construction, most of the emissions that will occur during operation of CCNPP Unit 3 will be from the cooling tower. Furthermore, the emissions will be released from a much higher elevation, which will result in greater dispersion of the emissions. For these reasons impacts at ground level are expected to be very low.

The maximum PM10 concentrations predicted by the model from the operation of all of the cooling towers were 0.6 $\mu g/m^3$ for the annual averaging period and 7.4 $\mu g/m^3$ for the 24-hour averaging period. The concentrations are extremely low and are virtually indistinguishable from the background levels expected at the site, i.e., 21 $\mu g/m^3$ for the annual period and 53 $\mu g/m^3$ for the 24-hour period, as measured at the Glenn Burnie monitoring station. The PM10 Federal and State standards are 50 $\mu g/m^3$ and 150 $\mu g/m^3$ for the annual and 24-hour periods, respectively. Figure 6.5-2 and Figure 6.5-3 show the location of the highest 24-hour concentration and annual average concentration isopleths predicted by the model for the Unit 3 sources during full operation of CCNPP Unit 3.

Air quality impacts were also completed for the PM2.5 emissions. The predicted maximum annual concentration for PM2.5 was 0.6 $\mu g/m^3$ and the 8th highest PM2.5 concentration was 6.4 $\mu g/m^3$. The 8th highest value follows the EPA guidance for evaluating compliance with this pollutant and averaging period. These predicted values can be compared to the standards of 15 $\mu g/m^3$ and 35 $\mu g/m^3$, respectively.

The impacts for the other pollutants are also miniscule. For nitrogen oxides the maximum annual impact predicted for the operation of the diesel stand-by generators is 0.1 $\mu g/m^3$ compared to the Federal and State standard of 100 $\mu g/m^3$ for the annual averaging period. For SO2 the predicted impact for the 24-hour period was 1.4 $\mu g/m^3$ versus the standard of 365 $\mu g/m^3$.

Clearly the air quality impacts for the operation of CCNPP Unit 3 are miniscule and will have virtually an imperceptible effect on air quality in the area surrounding the site.

6.5.3 Application for Permit-to-Construct

Included in the appendices is a permit application for the installation of the cooling towers and emergency generators required to authorize construction as minor sources under Maryland regulations (COMAR 26.11.02). The application is for the construction permits for a minor modification of an existing minor source.

6.6 ECOLOGICAL IMPACTS OF OPERATIONS

6.6.1 Terrestrial Impacts

This section describes the potential impacts to the terrestrial and aquatic ecologies during the operation of CCNPP Unit 3 and the associated onsite transmission facilities.

The terrestrial ecology of the CCNPP site was characterized in a series of field studies conducted between May 2006 and May 2007. Field studies included a flora survey, a faunal survey, a rare tiger beetle survey, a rare plant survey, and a Wetland Delineation Report. These studies are identified in Section 3, and copies are included as appendices.

Vegetation of the CCNPP Unit 3 project area was recently surveyed. Major plant communities comprise lawns and developed areas, old field, successional hardwood forest, mixed deciduous forest, mixed deciduous regeneration forest, well drained bottomland deciduous forest, poorly drained bottomland deciduous forest, and herbaceous marsh vegetation. A number of invasive exotic plant species occur, especially in association with disturbed areas. The Common Reed (*Phragmites australis*) and Japanese Stiltgrass (*Microstegium vimineum*) are abundant enough to degrade biodiversity and possibly prevent the occurrence of rare species. However, most of the project site landscape consists of regionally typical forest in various stages of maturation.

6.6.1.1 Important Terrestrial Species and Habitats

The following species and habitats of the project site have been designated as important according to Federal and State of Maryland criteria:

Species important because of rarity:

- Bald Eagle (*Haliaeetus leucocephalus*): USA Threatened, State Threatened
- Puritan Tiger Beetle (*Cicindela puritana*): USA Threatened, State Endangered
- Northeastern Beach Tiger Beetle (*Cicindela dorsalis dorsalis*): USA Threatened, State Endangered
- Showy Goldenrod (*Solidago speciosa*): State Threatened
- Shumard's Oak (*Quercus shumardii*): State Threatened
- Spurred Butterfly Pea (*Centrosema virginianum*): State Rare (unprotected)

Commercially or recreationally valuable species:

- White-tailed Deer (*Odocoileus virginianus*)

Species critical to the structure and function of local terrestrial ecosystems:

- Tulip Poplar (*Liriodendron tulipifera*)
- Chestnut Oak (*Quercus prinus*)
- Mountain Laurel (*Kalmia latifolia*)
- New York Fern (*Thelypteris noveboracensis*)

Species that could serve as biological indicators of effects on local terrestrial ecosystems:

- Scarlet Tanager (*Piranga olivacea*)

Important habitats:

- Herbaceous marsh – jurisdictional wetland
- Poorly drained bottomland deciduous forest – jurisdictional wetland
- Well drained bottomland deciduous forest – Federal floodplain status

6.6.1.2 Cooling Water System Impacts

Heat dissipation systems associated with nuclear power plants have the potential to impact terrestrial ecosystems through salt drift, vapor plumes, icing, precipitation modifications, noise, and avian collisions with cooling towers. The cooling tower constructed to provide heat dissipation for CCNPP Unit 3 would release drift capable of depositing as much as 2.1 lb/acre per month (2.4 kg/hectare per month) of dissolved solutes, primarily salt originating from the proposed brackish makeup water on terrestrial ecosystems at the eastern edge of the CCNPP site. Analyses have shown that the cooling tower drift is primarily to the east over the open water of the Chesapeake Bay, thereby minimizing impacts to terrestrial ecosystems, especially terrestrial ecosystems outside of the CCNPP site. The component of terrestrial ecosystems most vulnerable to cooling tower drift is vegetation, especially the upper stratum of vegetation whose foliage lies directly under the released droplets of water forming the drift. Most areas of natural vegetation in the terrestrial areas subject to the greatest drift consist of forest. Hence woody vegetation forming the tree canopy and woody understory is subject to the greatest exposure.

Acute vegetation damage from drift-based salt deposition originating at cooling towers whose makeup water is brackish has been shown to be minor, but uncertainty remains because of the limited information in the published scientific literature regarding the sensitivity of individual plant species to salt deposition. This is especially true with respect to low level chronic injury such as stunted growth that is not as visually apparent as acute injury such as browned leaves. The following analysis therefore focuses primarily on describing the risk of potential injury, especially low level chronic injury, to vegetation caused by the salt deposition rates projected for the CCNPP Unit 3 cooling tower.

Figure 6.6-1 depicts the areas of each plant community, as mapped and described in a flora survey report that would be affected by monthly salt deposition rates greater than 0.3 lb/acre (0.3 kg/hectare) from summer cooling tower drift. Most of the affected surface area within the isopleths extends over the open waters of the Chesapeake Bay, away from terrestrial vegetation. No vegetation anywhere would be exposed to salt deposition rates exceeding 2.1 lb/acre per month (2.4 kg/hectare per month).

Plant Communities Exposed to Highest Salt Deposition Levels

Less than 0.12 acres (0.04 hectares) of natural upland vegetation and no natural wetland and/or riparian forest vegetation would be exposed to the highest deposition rate of 1.1 to 2.1 lb/acre per month (approximately 1.2 to 2.4 kg/hectares per month). The exposed upland vegetation includes approximately 0.06 acres (0.02 hectares) of mixed deciduous forest, and approximately 0.06 acres (0.02 hectares) of old field vegetation. The affected vegetation is situated entirely within the CCNPP site, along the Chesapeake Bay shoreline northeast of the CCNPP Unit 3 power block location. The affected vegetation falls entirely within the CBCA, with most falling within the CBCA Buffer (The CBCA is an area of land that extends 1,000 ft (305 meters) inland from the shoreline at mean high tide and the Buffer is an area of the CBCA that extends 100 ft (30 m) inland from the shoreline at mean high tide).

Plant Communities Exposed to Lower Salt Deposition Rates

An additional area of approximately 2.21 acres (0.89 hectares) of natural upland vegetation and approximately 0.11 acres (0.04 hectares) of wetland vegetation on the CCNPP site would be exposed to a lower projected deposition rate of 0.1 to 1.1 lb/acre per month (0.1 to 1.2 kg/hectare per month). The additional upland vegetation on the CCNPP site includes approximately 1.87 acres (0.76 hectares) of mixed deciduous forest, approximately 0.02 acres (0.01 hectares) of successional hardwood forest, and approximately 0.33 acres (0.13 hectares) of old field vegetation. The additional wetland vegetation includes approximately 0.04 acres (0.02 hectares) of poorly drained bottomland deciduous forest and approximately 0.07 acres (0.03 hectares) of bottomland deciduous forest that could either be poorly drained (wetland) or well-drained riparian forest vegetation (not wetland). Most of the vegetation exposed to the lower salt deposition rate is situated within the CCNPP site, along the Chesapeake Bay shoreline northeast and southeast of the proposed power block location. However, vegetation exposed to the lower salt deposition rate would extend to approximately 0.36 acres (0.15 hectares) of forested privately-owned land in an in-holding along the Chesapeake Bay near the southeastern corner of the CCNPP site.

Potential Effects of Salt Deposition to Specific Plant Species

Information on the sensitivity of native plant species on the CCNPP site to salt drift is summarized in Table 6.6-1. This table is based on the results of the above referenced flora survey and information provided in an NRC report "Generic Environmental Impact Statement for License Renewal of Nuclear Plant" (NUREG-1437). According to NRC NUREG-1437, the most sensitive native plant species on the CCNPP site is flowering dogwood (*Cornus florida*), which experiences acute injury at salt deposition rates exceeding approximately 1.1lb/acre (1.2 kg/hectare) per week (or 4.6 lb/acre (5.2 kg/hectare) per month). The threshold level is based on observational data from forest vegetation affected by salt drift from cooling towers at the Chalk Point power plant, located less than 25 mi (40 km) west of the CCNPP site, and thus reflective of locally adapted flowering dogwood growing under similar climate and physiographic conditions. Flowering dogwood occurs occasionally in the understory of mixed deciduous forest and mixed deciduous regeneration forest on the CCNPP site but is not dominant in any vegetative stratum.

Because the highest salt deposition rate projected for the proposed cooling tower is only 2.1 lb/acre (2.4 kg/hectare) per month, the risk of acute injury to flowering dogwood appears low. Although acute injury is unlikely, there is still risk of chronic injury to flowering dogwood such as reduced growth rate and reduced vigor. Chronic injury might not be visible, but could leave affected trees more susceptible to environmental stresses such as drought or biotic stresses such as dogwood anthracnose, a fungal disease that has killed many dogwoods in Maryland. Because flowering dogwood is not a dominant tree in either the canopy or understory of forests on the CCNPP site based on the flora study, the overall character of the affected forest vegetation would not be substantially changed even if the few flowering dogwoods in the affected areas were to eventually die. The ability of the affected forest vegetation to provide habitat for forest interior dwelling (FID) species and other wildlife favoring forest habitat would not be substantially diminished.

Table 6.6-1 Salt Drift Deposition Rates Estimated to Cause Acute Injury to Vegetation

Native Plant Species		Occurrence on CCNPP Site	Reported Deposition Rate Threshold for Acute Injury to Vegetation	
Scientific Name	Common Name		lb/acre/week (kg/ha/week)	lb/acre/week (kg/ha/month)
Cornus florida	Flowering Dogwood	MDF-Occasional MDRF-Occasional	1.1 (1.2) (MD) 42.2 (47.4) (NY)	4.6 (5.2) (MD) 184.1 (206.7) (NY)
Fraxinus Americana	White Ash	None. However, Green Ash (*F. pennsyvanicum*) is occasional in PDBDF and WDBDF.	1.2 (1.3) (MD) 16.8 (18.9) (NY)	5.1 (5.7) (MD) 73.4 (82.4) (NY)
Tsuga Canadensis	Eastern Hemlock	None	8.4 (9.4)	36.5 (41.0)
Pinus strobus	White Pine	None. However, Virginia Pine (*P. virginiana*) is dominant in MDRF and SFV and occasional in MDF and OFV; and	168.9 (189.6)	736.3 (826.7)

		Loblolly Pine (*P. taeda*) is occasional in OFV, MDF, MDRF, and SFV.		
Quercus prinus	Chestnut Oak	MDF-Dominant MDRF-Dominant	337.7 (379.2)	1,472.6 (1653.3)
Robinia pseudoacacia	Black Locust	SFV-Dominant OFV-Occasional	337.7 (379.2)	1,472.6 (1653.3)
Acer rubrum	Red Maple	PDBDF-Dominant WDBDF-Dominant MDF-Occasional MDRF-Occasional	422.2 (474.0)	1,840.7 (2066.6)
Hammamelis virginiana	Witch Hazel	None	928.8 (1042.8)	4,049.6 (4546.6)

Notes:

L/DA: Lawns/Developed Areas
OFV: Old Field Vegetation
MDF: Mixed Deciduous Forest
MDRF: Mixed Deciduous Regeneration Forest
WDBDF: Well-Drained Bottomland Deciduous Forest
PDBDF: Poorly Drained Bottomland Deciduous Forest
HMV: Herbaceous Marsh Vegetation
SFV: Successional Forest Vegetation

Of the dominant tree species in the potentially affected vegetation, NUREG-1437 provides information only for chestnut oak (*Quercus prinus*), which is dominant in mixed deciduous forest; black locust (*Robinia pseudoacacia*), which is dominant in successional hardwood forest; and red maple (*Acer rubrum*), which is dominant in the well-drained and poorly-drained bottomland hardwood forest cover that occurs in wetlands and floodplains as shown in Table 6.6-1. The minimum salt deposition rates reported to cause acute injury to each of these three species is more than two orders of magnitude higher than the maximum deposition of 2.1 lb/acre (2.4 kg/hectare) per month projected for the CCNPP Unit 3 cooling tower. Although the potential for chronic injury to these species can not be definitively ruled out, the risk appears to be substantially lower than for flowering dogwood.

The salt tolerance of other dominant tree species in the affected vegetation is not addressed in NUREG-1437. Of particular importance are tulip poplar (*Liriodendron tulipifera*), American beech (*Fagus grandifolia*), and various upland oak species, which are dominant in mixed deciduous forest; and sweet gum (*Liquidambar styraciflua*), black gum (*Nyssa sylvatica*), and black willow (*Salix nigra*), which are dominant in bottomland forests (poorly drained bottomland deciduous forest). Table 6.6-2 presents information on the relative salt tolerance of several tree and shrub species not addressed in NUREG-1437. The information in Table 6.6-2 is less directly applicable than that in NUREG-1437. It is mostly based on reported tolerance to salt spray generated by vehicles traveling on roadways treated with deicing salt. Deicing salt exposure differs from cooling tower salt deposition in that the former occurs only episodically during the winter, when most deciduous trees are leafless, while the latter occurs more evenly throughout the year. Furthermore, the designations in Table 6.6-2 are based on empirical observations of visible stress along salt-treated roadways and are not tied to quantified salt deposition rates. Nevertheless, the information in Table 6.6-2 provides at least some information on the relative salt tolerance of species in the affected area that can help reduce uncertainty over their expected response to cooling tower drift.

Table 6.6-2 notes several reports of salt tolerance by white oak, although it also notes contrasting reports of salt sensitivity. The information on white oak in Table 6.6-2, combined with the general salt drift tolerance reported in NUREG-1437 for chestnut oak, suggests that areas of mixed deciduous forest (and mixed deciduous regeneration forest) dominated by oaks have a relatively low risk of experiencing substantial injury from the expected cooling tower drift.

.

Table 6.6-2 Salt Spray Tolerance Data for Plant Species Observed on the CCNPP Site

Scientific Name	Common Name	L/DA	OFV	MDF	MDRF	WD BDF	PD BDF	HMV	Salt Spray Tolerance
Trees									
Acer rubrum	Red Maple			X	X	X	X	X	NRC NUREG-1437: Tolerant Below 1844 lb/acre/month (2,066 kg/ha/mo) (Dirr, 1976): Poor to Moderate Salt Tolerance (Canada, 2001): Intermediate Tolerance to Salt Spray (Hightshoe, 1988): Sensitive to salt
Ailanthus altissima	Tree of Heaven		X						No data identified regarding salt spray tolerance.
Albizzia julibrissin	Mimosa		X						No data identified regarding salt spray tolerance.
Betula lenta	Black Birch			X	X				(Dirr, 1976): Good salt tolerance (Hightshoe, 1988): Intermediate salt tolerance
Carpinus caroliniana	Ironwood			X	X	X			(Dirr, 1976): Poor salt tolerance
Carya cordiformis	Bitternut Hickory			X					(Dirr, 1976): Poor salt tolerance for Genus Carya. (Hightshoe, 1988): Sensitive to salt
Carya glabra	Pignut Hickory			X	X				(Dirr, 1976): Poor salt tolerance for Genus Carya. (Hightshoe, 1988): Sensitive to salt
Cornus florida	Flowering Dogwood			X	X				NRC NUREG-1437: Tolerant Below 4.6 lb/acre/month (5.2 kg/ha/mo)
Fagus grandifolia	American Beech			X	X	X			(Dirr, 1976): Poor to Moderate Salt Tolerance (Canada, 2001): Sensitive to Salt Spray (Hightshoe, 1988): Sensitive to salt
Fraxinus pennsylvanicus	Green Ash					X	X		(Dirr, 1976): Moderate to Good Salt Tolerance (Appleton, 2003): Tolerant of Salt Spray (Hightshoe, 1988): Intermediate salt tolerance

Scientific Name	Common Name	L/DA	OFV	MDF	MDRF	WD BDF	PD BDF	HMV	Salt Spray Tolerance
Ilex opaca	American Holly			X	X	X			(Dirr, 1976): Good salt tolerance (Appleton, 2003): Tolerant of Salt Spray
Juniperus virginiana	Eastern Redcedar		X						(Dirr, 1976): Moderate to Good Salt Tolerance (Appleton, 2003): Tolerant of Salt Spray (Hightshoe, 1988): Resistant to salt
Liquidambar styraciflua	Sweet Gum		X	X	X	X	X	X	(Appleton, 2003): Tolerant of Salt Spray
Liriodendron tulipifera	Tulip Poplar			X	X	X			(Dirr, 1976): Poor salt tolerance
Magnolia virginiana	Sweetbay						X		No data identified regarding salt spray tolerance.
Nyssa sylvatica	Black Gum			X	X	X	X	X	(Dirr, 1976): Good salt tolerance (Appleton, 2003): Tolerant of Salt Spray (Hightshoe, 1988): Resistant to salt
Paulownia tomentosa	Paulownia		X						No data identified regarding salt spray tolerance.
Pinus taeda	Loblolly Pine		X	X	X				No data identified regarding salt spray tolerance.
Pinus virginiana	Virginia Pine		X	X	X				No data identified regarding salt spray tolerance.
Platanus occidentalis	American Sycamore					X	X		No data identified regarding salt spray tolerance.
Prunus serotina	Black Cherry		X	X	X				(Appleton, 2003): Tolerant of Salt Spray (Hightshoe, 1988): Resistant to salt
Quercus alba	White Oak			X	X	X			(Dirr, 1976): Mostly good salt tolerance, one report of poor tolerance (Canada, 2001): Sensitive to intermediate tolerance to Salt Spray (Hightshoe, 1988): Resistant to salt

Scientific Name	Common Name	L/DA	OFV	MDF	MDRF	WD BDF	PD BDF	HMV	Salt Spray Tolerance
Quercus coccinea	Scarlet Oak			X	X				No data identified regarding salt spray tolerance.
Quercus falcata	Southern Red Oak			X	X				No data identified regarding salt spray tolerance.
Quercus michauxii	Swamp Chestnut Oak					X			No data identified regarding salt spray tolerance.
Quercus palustris	Pin Oak					X	X		(Canada, 2001): Sensitive to Intermediate Tolerance to Salt Spray
Quercus prinus	Chestnut Oak			X	X				NRC NUREG-1437: Tolerant Below 1,475 lb/acre/mo (1,653 kg/ha/mo)
Quercus shumardii	Shumard's Oak					X			No data identified regarding salt spray tolerance.
Quercus stellata	Post Oak		X						No data identified regarding salt spray tolerance.
Quercus velutina	Black Oak			X	X				(Canada, 2001): Sensitive to Intermediate Tolerance to Salt Spray
Robinia pseudoacacia	Black Locust		X						NRC NUREG-1437: Tolerant Below 1,464 lb/acre/month (1,653 kg/ha/mo) (Dirr, 1976): Good salt tolerance (Hightshoe, 1988): Resistant to salt
Salix nigra	Black Willow		X				X	X	(Dirr, 1976): Moderate salt tolerance (Canada, 2001): Intermediate Tolerance to Tolerance of Salt Spray (Hightshoe, 1988): Intermediate salt tolerance
Sassafras albidum	Sassafras		X	X	X	X			No data identified regarding salt spray tolerance.
Ulmus rubra	Slippery Elm					X	X		No data identified regarding salt spray tolerance.
Shrubs									
Alnus serrulata	Common Alder						X	X	(Hightshoe, 1988): Sensitive to salt
Amalanchier sp.	Shadbush			X		X	X		No data identified regarding salt spray tolerance.

Scientific Name	Common Name	L/DA	OFV	MDF	MDRF	WD BDF	PD BDF	HMV	Salt Spray Tolerance
Aralia spinosa	Hercules Club		X						No data identified regarding salt spray tolerance.
Asimina trilobata	Pawpaw			X	X	X			No data identified regarding salt spray tolerance.
Baccharis halimifolia	Groundsel Tree		X						(Hightshoe, 1988): Resistant to salt
Castanea dentate	American Chestnut			X					No data identified regarding salt spray tolerance.
Gaylussacia baccata	Black Huckleberry			X	X				No data identified regarding salt spray tolerance.
Kalmia latifolia	Mountain Laurel			X	X	X			(Hightshoe, 1988): Intermediate salt tolerance
Lindera benzoin	Spicebush			X					(Hightshoe, 1988): Resistant to salt
Lonicera sp.	Bush Honeysuckle		X						No data identified regarding salt spray tolerance.
Lyonia mariana	Staggerbush			X					No data identified regarding salt spray tolerance.
Myrica cerifera	Wax Myrtle		X						(Appleton, 2003): Tolerant of Salt Spray
Rhododendron sp.	White Azalea			X					No data identified regarding salt spray tolerance.
Rosa multiflora	Multiflora Rose		X						No data identified regarding salt spray tolerance.
Vaccinium corymbosum	Highbush Blueberry					X	X		(Hightshoe, 1988): Resistant to salt
Viburnum dentatum	Arrowwood			X		X	X		(Dirr, 1976): Poor salt tolerance for Genus Viburnum. (Appleton, 2003): Tolerant of Salt Spray

Scientific Name	Common Name	L/DA	OFV	MDF	MDRF	WD BDF	PD BDF	HMV	Salt Spray Tolerance
Viburnum nudum	Possum Haw						X	X	(Dirr, 1976): Poor salt tolerance for Genus Viburnum.

Notes:

L/DA: Lawns/Developed Areas
OFV: Old Field Vegetation
MDF: Mixed Deciduous Forest
MDRF: Mixed Deciduous Regeneration Forest
WDBDF: Well-Drained Bottomland Deciduous Forest
PDBDF: Poorly Drained Bottomland Deciduous Forest
HMV: Herbaceous Marsh Vegetation

Table 6.6-2 References:

Appleton, 2003. Trees and Shrubs that Tolerate Saline Soils and Salt Spray Drift, B. Appleton, A. Smith, and S. French, Virginia Cooperative Extension, Publication Number 430-031, January 2003.

Canada, 2001. Canadian Environmental Protection Act, Priority Substances List, Assessment Report, Road Salts, Health Canada, July 2001.

Dirr, 1976. Selection of Trees for Tolerance to Salt Injury, Journal of Arboriculture 12(2): 209-216, 1976.

Hightshoe, 1988. Native Trees, Shrubs, and Vines for Urban and Rural America, G. Hightshoe, Van Nostrand Reinhold Inc, New York, 1988.

Tulip poplar, which is codominant with oaks in the mixed deciduous forest, especially in the eastern part of the CCNPP site where the projected salt drift exposure would occur, is listed on Table 6.6-2 as having a poor salt tolerance. However, the distribution of tulip poplar in the mixed deciduous forest on the CCNPP site tends to favor areas of deeper, richer soils. It may therefore be able to better resist environmental stresses caused by salt drift.

Table 6.6-2 and NUREG-1437 suggest that each of the dominant species in poorly drained bottomland deciduous forest (forested wetlands) on the CCNPP site is relatively resistant to salt spray. Red maple is addressed in NUREG-1437, where data suggest that it is tolerant of salt deposition rates more than two orders of magnitude higher than the maximum projected rate for the new cooling tower. Information listed on Table 6.6-2 suggest that the Red Maple may be more susceptible to salt damage. Table 6.6-2 notes several reports of salt tolerance for black gum, one report of tolerance for sweet gum, and several reports of intermediate (or moderate) salt tolerance for black willow. The combined data suggest that there is less risk to wetland forest vegetation than to upland forest vegetation. Additionally, the wetland vegetation is less susceptible than upland vegetation to drought, which could act synergistically with the projected low salt deposition levels to mitigate injury to trees.

Potential Overall Effects of Salt Deposition on Terrestrial Ecosystems

Because the highest projected salt deposition rate (2.1 lb/acre (2.4 kg/hectare) per month) is below the rates reported in the scientific literature to cause acute injury to woody vegetation, the likelihood of salt drift causing rapid or extensive changes to the general structure and composition of affected vegetation is low. The tree canopy in forested areas is unlikely to die rapidly or extensively. Hence, conversion of forest to scrub-shrub vegetation unsuited to wildlife favoring forested habitat, including FID species, is unlikely. The ability of affected forest vegetation to stabilize soil on steep slopes is unlikely to be impaired.

Occasional trees or shrubs, especially in the area of higher salt deposition (0.3 to 2.1 lb/acre (0.3 to 2.4 kg/hectare) per month), could experience chronic injury such as reduced vigor, reduced growth rate, or slow and gradual die off. The risk is greatest for individuals that are simultaneously of a salt-sensitive species (such as flowering dogwood), old, or subject to localized environmental stresses such as sandy soils in which they are subject to greater drought stress. Small gaps in the tree canopy resulting from the death of individual trees would mimic the natural die-off of individual trees in mature forests and not substantially alter the suitability of the forests for most wildlife species. Dead trees would be left in place to provide nesting cavities and snags for wildlife.

The potential for injury to terrestrial vegetation or to terrestrial wildlife inhabiting areas of terrestrial vegetation, as a result of salt drift, is low. Thus, the impacts of salt drift on terrestrial ecology would be minimal, and would not warrant mitigation.

Potential Impacts of increased Fogging, Humidity, and Precipitation

The CCNPP site occurs in a naturally humid climate where natural vegetation is already adapted to frequent fog and high humidity, as well as occasional glaze ice (freezing rain) during the winter. The relative humidity at Patuxent River Naval Air Station, approximately 12 mi (19 km) south of the CCNPP site, was above 75% for nearly 50% of the time from 2001 to 2005, between 50% and 75% for 37% of the time during that period, and less than 50% for only about 15% of the time. Similar relative humidity data were reported for Baltimore Washington International Airport over the same time period. Increases in ground level relative humidity from the operation of the cooling tower would therefore not be substantial. Natural vegetation close to the cooling tower might benefit from the slightly increased humidity during drought periods. During wet periods, the slightly increased humidity might create a more favorable microenvironment for growth of fungal plant pathogens such as the causal agent of dogwood anthracnose. However, the generally humid climate in forest settings around the Chesapeake Bay already provides a favorable environment for fungal plant pathogens, whose distribution is mostly a factor of conveyance by wind, animals, or human-carried nursery stock. The potential impacts from the slight increases in ground level humidity are therefore expected to be small and not require mitigation.

The hybrid cooling tower will not create a visible plume and therefore will not reduce the amount of sunlight reaching the ground. Because the water vapor plume is released at a temperature above the dew point, we would not expect any additional precipitation in the form of rain or snow from the proposed cooling tower. Finally, since there will not be any water droplets released from the CWS tower, icing from plume downwash is not expected to occur.

Potential Impacts Due to Bird Collisions with Cooling Towers

The proposed cooling tower would not be expected to cause substantially elevated bird mortality due to collisions. The CWS cooling tower is a low-profile design, as compared to other cooling tower systems, and therefore poses less of a threat to flying birds. Although infrequent bird collisions with the proposed cooling tower are possible, the overall mortality potentially resulting from bird collisions with cooling towers is reported to have only minor impacts on bird species populations in NUREG-1437. The forest interior bird species would not find suitable habitat close to the cooling towers, which would be constructed on a cleared, treeless pad. Lights would be installed on the cooling towers to reduce the probability of collision by eagles or raptors migrating parallel to the western shore of the Chesapeake Bay. No other mitigation appears to be necessary to prevent substantial adverse impacts to bird species populations caused by collisions with the cooling tower.

Similar Operating Heat Dissipation Systems

Data and information on similar heat dissipation systems within a 31 mi (50 km) radius or similar climate are available for the Chalk Point coal-fired plant located on the Patuxent River and the Hope Creek Nuclear Plant. The Chalk Point coal-fired plant and Hope Creek Nuclear Plant both use a natural draft cooling tower with salt or brackish water as the makeup water. At these plants, impacts from salt drift have not been observed. There are no large cooling tower systems in the vicinity of the CCNPP site that would create any synergistic effects with the proposed CWS cooling tower with respect to drift.

Potential Impacts from Cooling Tower Noise

Noise caused by human and vehicular activity at the CCNPP Unit 3 could discourage use by terrestrial wildlife of adjoining natural habitats on the CCNPP site. However, noise generated by operation of the cooling tower is unlikely to have deleterious effects on wildlife. Like other mechanical draft cooling towers, the proposed cooling tower with its plume abatement system would emit broadband noise, which is considered to be largely indistinguishable and nonobtrusive. Wildlife is generally more sensitive to sudden and random noise events, which can induce a startle response similar to that induced by a predator, than to the steady continuous noise produced by operation of a cooling tower.

The expected noise levels generated by the CWS cooling tower are estimated to be 65 dBA or less at the distance of approximately 1,300 ft (396 m) from the cooling tower. The State of Maryland stipulates noise limits based on the classification of the receiving land (55 dBA Ldn for residential land). Ldn is a calculated day-night time average noise level based on an hourly average of the equivalent noise level (Leq) over a 24 hour period. As a rule of thumb for a continuously and invariant operating noise source, the Ldn value is 6.4 dBA higher than the average Leq value. The Leq noise limit is therefore 55 dBA to 6.4 dB or 48.6 dBA. Based on distance losses, the 48.6 dBA (Leq) noise limit will be met within a

7,700 ft (2,347 m) radius from the towers. Most of the documented adverse noise-related impacts to mammals, birds, and other terrestrial wildlife are at levels greater than 80 to 90 dBA. The potential adverse impacts to terrestrial wildlife caused by cooling tower noise are expected to be minimal.

6.6.1.3 Transmission System Impacts to the Terrestrial Ecology

This section considers the effects on the terrestrial ecosystem of the transmission facility associated with CCNPP Unit 3 and modifications to the existing transmission system required to connect the additional generation capacity from the unit. The review evaluates the significance of these predicted impacts on important terrestrial species and habitats, and evaluates alternative practices to mitigate the impacts, as needed.

Potential Adverse Effects of Operation and Maintenance Practices

The transmission system consists of a new approximately 20 acre (8 hectare) onsite substation and four 1 mi (1.6 km) connecting circuit lines with associated towers, also on the CCNPP site. Two of these circuits would connect directly to the existing Baltimore Gas & Electric Company (BGE) transmission system and the other two circuits would connect to the existing onsite CCNPP Units 1 and 2 substation. Modifications to offsite transmission facilities will be implemented within the existing substations.

The CCNPP site follows the standard industry practices for operation and maintenance of transmission line right-of-ways. Vegetation management is practiced to avoid any power outages and injury to the public and company employees from overgrown or diseased trees. Trees are pruned or cut, and integrated vegetation management performed, according to the relevant American National Standards Institute (ANSI) standards.

Routine maintenance in and along the transmission corridor right-of-way requires cutting of herbaceous and low woody growth once a year, and cutting of saplings, larger shrubs and small trees once every five years. Herbicide applications are used only on an occasional basis, if at all. Access roads for construction and subsequent maintenance are stabilized wherever necessary with a course of stones to prevent formation of ruts and gullies in the exposed soil. These road surfaces will be allowed to grass over and will be cut only as necessary to maintain occasional vehicular access.

Additional adverse impacts would ensue from erosion of poorly stabilized soil if left exposed by excavation and the movement of heavy equipment and workers during construction. These effects can be prevented by implementation of best management practices to control stormwater runoff. Erosion and sedimentation impacts are subject to project control, and are not anticipated to be significant with the adoption of the planned mitigation measures. As noted above, herbaceous vegetation will be encouraged to cover road surfaces within the transmission line corridor to improve long-term post-construction stability.

Impacts on land use and scenery are considered to remain virtually unaltered by the proposed changes to power line corridor operation and maintenance activities, and do not warrant mitigation.

Maintenance of the newly cleared segment of the onsite power line corridor might provide new opportunities for the brown-headed cowbird, a nest parasite, to penetrate the forest edge and impair the nesting success of host birds, including some forest-interior bird species like the scarlet tanager. Although considered a slight impact, this adverse impact would persist as long as the power line corridor is maintained in a primarily old-field stage of ecological succession adjoining sizeable forest tracts. The power line corridor is subject to direct adverse impacts in the form of intermittent disruptions associated with control of corridor vegetation by maintenance cutting activities. These impacts could include the mortality of small, relatively sedentary vertebrates and invertebrates, and the reduction of breeding success for other animal species, none of which are listed as important species.

White-tailed deer should continue to benefit over the long term from operation and maintenance of the power line right-of-way as a permanent old-field habitat, with its abundant supply of low vegetation for grazing and browsing.

Operation and maintenance activities for the transmission lines are sufficiently distant from the existing four Bald Eagle nest sites on the CCNPP site that they will not be impacted by operation. Because hunting activities by Bald Eagles tend to concentrate on the coastline and large water bodies, they are unlikely to be affected by transmission line operations. In recent years there has been one known incident of an immature Bald Eagle dying from electrocution on a Southern Maryland Electric Cooperative (SMECO) power line. Based on over 30 years of CCNPP plant operation, repetition of this kind of accident appears unlikely.

The puritan tiger beetle species breeds exclusively on the coastal bluff and immediately below it, and consequently would not be disturbed by power line operations and maintenance.

As described above, the scarlet tanager may undergo a slight negative effect of nest parasitism in proximity to the right-of-way. There also may be continuously adverse impacts on this and other forest-interior bird species from competition with and predation by forest-edge vertebrate species.

Management of the power line right-of-way as a permanent opening may eventually prove to have beneficial impacts on the three rare herbaceous plants identified. These three species grow in a well-drained bottomland deciduous forest environment where the forest canopy is broken, as reported in the rare plant survey. Shumard's Oak was observed near the CCNPP Unit 3 project area. Shumard's Oak may regenerate in the right-of-way, but would not survive to maturity under the 5 year cutting schedule for vegetation control. It should not be disturbed during construction and operation of CCNPP Unit 3. The Spurred Butterfly Pea was possibly observed near the CCNPP Unit 3 project area but should not be disturbed during construction and operation. The Showy Goldenrod will be transplanted to open field areas onsite that are outside the construction footprint and the new transmission line right-of-way. The four plant species critical to the structure of the local terrestrial ecosystem listed on Table 6.6-2 would have no significant interaction, either positive or negative, with power line operation and maintenance activities. The four plant species are the:

- Tulip Poplar (*Liriodendron tulipifera*),
- Chestnut Oak (*Quercus prinus*),
- Mountain Laurel (*Kalmia latifolia*), and
- New York Fern (*Thelypteris noveboracensis*).

These four species are key contributors to the overall structure and ecological function of the CCNPP site plant communities. They serve as an indicator of the ecological stability of the CCNPP site. The Tulip Poplar and Chestnut Oak together comprise the majority of the tree canopy in the forested areas on or surrounding the CCNPP site. Both tree species prefer moist, slightly acidic soil in full sun. The Mountain Laurel is the most widespread shrub on the CCNPP site and forms dense shrub thickets in the understory of the upland forest. It grows best in cool, moist, acidic soil with partial shade to full sun. The New York Fern is the most widespread ground cover plant and forms large dense patches throughout most of the forested floodplain. It grows best in moist woods in filtered light and moist areas along banks and streams. Therefore, an open field environment in the transmission line right-of-way would not be conducive to or hinder the growth of these four dominant plant species.

Wetland habitats typical of the naturally forested landscapes throughout the CCNPP Unit 3 project area gain in biodiversity when exposed to the frequent cutting regime of the power line right-of-way. Indirect impacts on all three of the above mentioned forest habitats would be negligible, given observance of sound erosion-control measures.

The height of the transmission lines will meet the National Electric Safety Code (NESC) requirements (ANSI/IEEE, applicable version) to prevent induced current due to electrostatic effects for any ecological species by assuming a large truck or farm machinery may travel underneath the transmission lines. Therefore, there are no adverse effects due to induced current.

Noise impacts associated with the transmission system lines are due to corona discharge (a crackling or hissing noise). Corona noise for a 500 kV line has been estimated to be 59.3 dBA during a worst case rain with heavy electrical loads. Although this is higher than the 55 dBA environmental goal, normal speech has a sound level of approximately 60 dBA. Therefore, noise from the transmission lines is not expected to have an adverse effect on the terrestrial ecology.

Measures and Controls to Mitigate Potential Transmission Line Impacts

Project design attempts first to avoid impacts on wetlands, and on other important habitats as well as important species. Where impacts are unavoidable, they are minimized to the greatest possible extent. Unavoidable impacts are then mitigated as part of the overall project plan.

The bare soil exposed on access roads will be rendered stable by covering it with a permeable cover of loose stone through which vegetation will be encouraged to grow to improve long-term post-construction stability. All other areas of disturbed soil will be similarly revegetated and maintained in such condition as a routine part of right-of-way management.

The Showy Goldenrod population identified at Camp Conoy will be relocated to open field areas to avoid destruction by the CCNPP Unit 3 site preparation and construction. The transplantation of the goldenrod to open field areas, followed by periodic monitoring, is a cost-effective form of mitigation. As noted earlier, construction and transmission line activities should not disturb the site areas where the Shumard's Oak and Spurred Butterfly Pea are possibly located.

Biocides will be used sparingly if ever, in response to highly selective problems, and away from water, under the exclusive control of a licensed biocide applicator.

Streams and wetlands in the right-of-way that are connected with water bodies containing fish will be maintained in as well-shaded a state as possible to minimize the warming effect of direct sunlight on surface water.

There are no ongoing formal wildlife management practices on the project site. Affected federal, state and local agencies will be contacted regarding the potential impacts to the terrestrial ecosystem resulting from transmission system operation and maintenance. The Maryland Natural Heritage Program, part of DNR, was consulted for information on known occurrences of Federally-listed and State-listed threatened, endangered, or special status species and critical habitats. Identification of the important species discussed above was based in part on information provided by that consultation.

6.6.2 Aquatic Impacts

This section summarizes the measures and controls to be implemented during the operation of CCNPP Unit 3 to limit potential adverse aquatic impacts. Aquatic impacts are attributable to the operation of the cooling water system intake, the combined thermal and wastewater discharge, and the power transmission facility.

6.6.2.1 Cooling Water System Intake Impacts

Aquatic impacts attributable to operation of the CCNPP Unit 3 cooling water system intake structures are impingement and entrainment. Impingement occurs when larger organisms become trapped on the intake screens and entrainment occurs when small organisms pass through the traveling screens and subsequently through the cooling water system. Factors that influence impingement and entrainment include cooling system and intake structure location, design, construction and capacity. CWA Section 316(b) requires that cooling water intakes represent "Best Technology Available" for these criteria. The U.S. EPA promulgated regulations implementing Section 316(b) in 2001 for new facilities (40 CFR Part 124, Subpart I, 125.84(b)). The CCNPP Unit 3 intake and cooling water systems conform to these criteria.

The U.S. EPA design criteria for Phase I new facilities and how CCNPP Unit 3 will comply with these requirements is summarized below.

1) *Reduce intake flow, at a minimum, to a level commensurate with that which can be attained by a closed-cycle recirculating cooling water system.*

The CCNPP Unit 3 cooling system will be a closed-cycle, recirculating, wet cooling system. (*See* Sections 2.3.3 and 6.2.1.1).

2) *Design and construct each cooling water intake structure to achieve a maximum through-screen velocity of 0.5 f/s.*

The design of the intake structure is based on achieving an approach velocity of less than 0.5 f/s (see Section 6.4.3.1).

3) *The total design intake flow over one tidal cycle of ebb and flow must be no greater than one (1) percent of the water volume of the water column within the area centered about the opening of the intake with a diameter defined by the distance of one tidal excursion at the mean low water level.*

The intake flow design rate will not exceed one percent of the calculated water column volume criterion. The maximum design intake flow rate is 43,480 gpm (164,582 lpm). Over an approximate 12 hour tidal cycle this equates to 31 million gallons (119 million liters or 0.119 cubic meters). The tidal excursion distance (diameter) is estimated to be 5.3 kilometers, with an average depth of 15 meters over this distance. The resultant water column estimate is 1,324 million meters. The one percent limit of 13 million cubic meters, far exceeds the estimated maximum intake volume of 0.119 cubic meters.

4) *Select and implement design and construction technologies or operational measures for minimizing impingement mortality of fish and shellfish, if:*

- *There are threatened, endangered or otherwise protected species potentially impacted; and*
- *Migratory, sport or commercial species pass through the hydraulic zone of influence.*

5) Select and implement design and construction technologies or operational measures for minimizing entrainment of entrainable life stages of fish and shellfish, if:

- *There are threatened, endangered or otherwise protected species potentially impacted; and*

- *There would be undesirable cumulative stressors affecting entrainable life stages of species of concern.*

The intake structures for CCNPP Unit 3 will incorporate fish and invertebrate protection measures that maximize impingement survival including fish return systems similar to those employed at Units 1 and 2. Moreover, because the through-trash rack and through-screen mesh flow velocities will be less than 0.5 ft/sec (0.15 m/sec), in the worst case scenario (minimum Chesapeake Bay level with highest makeup demand flow), proposed CCNPP Unit 3 represents the BTA.

Maryland also established cooling water system requirements (COMAR 26.08.03.05) that require "[t]he location, design, construction, and capacity of cooling water intake structures shall reflect the best technology available (BTA) for minimizing adverse environmental impact" determined by:

- Installation and operation of functional modifications to mitigate impingement loss based on economic considerations including the value of the resource compared to corrective actions, and

- Determination of the extent to which entrainment loss affects a spawning or nursery area for representative important species, and corrective actions if necessary.

Important ecological impact findings reported by Martin Marietta and later supported by the State of Maryland Power Plant Research Program are as follows:

- The CCNPP site area was not a spawning area for species of commercial or recreational value,

- Field data showed no consistently detectable depletions of ichthyoplankton in the plant vicinity,

- The magnitude of impingement from CCNPP Units 1 and 2 intake appeared insufficient to substantially modify the ecosystem in the CCNPP site region, and

- Ecological and economic projections suggested entrainment impacts would be very limited in magnitude and spatial extent.

The evaluation of compliance with the State of Maryland power plant cooling water intake regulations requires an assessment of the relative value of the resource to be protected compared to the cost of additional measures that may be needed to further reduce impingement and entrainment impacts.

The impact of CCNPP Units 1 and 2 intake represents less than 0.1% of commercial landings. Given the relatively small amount of cooling water flow required for CCNPP Unit 3, the incremental effects of impingement and entrainment should be a small fraction of recreational and commercial harvest rates.

A summary of over 10 years of macrobenthic studies conducted from 1968 through 1978 also provided evidence that potential impacts of entrainment on key commercial and recreational species including the American oyster, soft shell clam and blue crab were minimal. Conclusions were as follows:

- The CCNPP site area was not a major oyster spawning area,

- After CCNPP Unit 1 and 2 operation began, soft shell clam production was consistently higher at the plant sampling site than at reference locations, and

- Very few planktonic stages of Blue Crabs occurred as far up the Chesapeake Bay as the CCNPP site area.

Protected aquatic species potentially found in the vicinity of the intake structures include the Shortnose Sturgeon (*Acipenser brevirostrum*), Atlantic Sturgeon (*Acipenser oxyrhynchus*) and the Spotfin Killifish (*Fundulus luciae*). Both the Shortnose and Atlantic Sturgeon spawn in fresh waters and the migration of young downstream does not occur until the late larval stage. As a result, the eggs and young larvae of these two species are unlikely to be affected by entrainment in the cooling water intake of CCNPP Unit 3.

In the many years of sampling at CCNPP site area, only one Shortnose Sturgeon was caught in trawls; none impinged. The spotfin killifish frequents tidal marshes in saline systems and is unlikely to be abundant within the unique habitat found along the Calvert Cliffs shoreline. The NRC consulted with the U.S. Fish and Wildlife Service and the National Marine Fisheries Services (NMFS) regarding additional protective measures relative to the CCNPP Unit 1 and 2 license renewal and determined that there is little likelihood for adverse impacts to endangered or threatened aquatic species and that no additional measures beyond those already implemented at the CCNPP site were necessary. Operation of CCNPP Unit 3 with closed-cycle cooling systems and fish protection measures incorporated into the intake should limit any incremental effect beyond that already evaluated.

Additional regulatory protection has been provided by the NMFS under the Magnuson-Stevens Fishery Conservation Management Act (16 USC Sections 1801-1883) for certain species with unique or otherwise "essential fish habitat" requirements as shown in Table 6.6-3. Impingement and entrainment data collected at the CCNPP site indicate that certain of these species occur at some life stage in the vicinity of the site. However, their overall abundance in impingement and entrainment samples has been low, and in most cases represents less than 1% of species composition. The dominant species that occur in monitoring at CCNPP have not been identified as requiring Habitat Areas of Particular Concern (HAPC) designations.

Table 6.6-3 Species Identified as Having Essential Fish Habitat Requirements in the Chesapeake Bay

Species	Eggs	Larvae	Juveniles	Adults	Spawning Adults
Windowpane Flounder (*Scopthalmus aquosus*)			X	X	
Bluefish (*Pomatomus saltatrix*)			X	X	
Atlantic Butterfish (*Peprilus triacanthus*)	X	X	X	X	
Summer Flounder (*Paralicthys dentatus*)		X	X	X	
Black Sea Bass (*Centropristus striata*)			X	X	
King Mackerel (*Scomberomorus cavalla*)	X	X	X	X	
Spanish Mackerel (*Scomberomorus maculatus*)	X	X	X	X	
Cobia (*Rachycentron canadum*)	X	X	X	X	
Red Drum (*Sciaenops occelatus*)	X	X	X	X	
Red Hake (*Urophycis chuss*)			X	X	
Scup (*Stenotomus chysops*)			X	X	
Atlantic Sea Herring (*Clupea Harengus*)				X	

Of the species listed with HAPC, summer flounder was identified as having nursery requirements that may be found in the Chesapeake Bay. The specific habitat considered for protection was submerged aquatic vegetation (SAV) that provides food and protection for larval and juvenile stages. A survey of SAV conducted throughout the Chesapeake Bay since the early 1970s found no discernible beds in the vicinity of the CCNPP site. No SAV was located during the surveys conducted in the immediate vicinity of the CCNPP site during 2006.

Potential impacts from impingement and entrainment of key representative important species have been reviewed by the NRC and DNR Power Plant Research Program. The DNR concluded that after many years of study, potential impacts encompassing all of the various power generation facilities in the State of Maryland waters have not resulted in a depletion of populations. The NRC concluded in its Environmental Impact Statement regarding the license renewal for CCNPP Units 1 and 2 that any impacts were small and that mitigative measures beyond those already implemented at CCNPP Units 1 and 2 were not warranted.

Based on the facts that (1) the proposed cooling tower-based heat dissipation system will, under normal circumstances, withdraw small amounts of the Chesapeake Bay water compared to CCNPP Units 1 and 2, (2) the design of the intake structures and cooling water system incorporates a number of features that will reduce impingement and entrainment, and (3) experience that suggests that the Chesapeake Bay fish and shellfish populations have not been adversely affected by operation of CCNPP Units 1 and 2, it is concluded that the impacts of the intakes for the cooling water systems will not be significant and do not warrant mitigation measures beyond the design features previously discussed.

6.6.2.2 Cooling Water System Discharge Impacts

The thermal discharge from CCNPP Unit 3 will return blowdown from the cooling towers and site wastewater streams to the Chesapeake Bay. The power plant discharge effects could include attraction of fish to the thermal plume, cold shock, blockage to movement and migration, changes in benthic species composition, growth of nuisance species, alteration of reproductive patterns, and chemical effects of biocides. These effects have been studied extensively at CCNPP Units 1 and 2, which provides a basis for assessing the potential ecological consequences of the CCNPP Unit 3 discharge.

The absence of harm caused by the CCNPP Units 1 and 2 discharge to key species of concern, including recreationally and commercially important species, provides evidence that the incremental discharge of cooling tower blowdown and wastewaters from CCNPP Unit 3 will have minimal impact on the Chesapeake Bay in the CCNPP site area.

Thermal Effects

The CCNPP Unit 3 plume is predicted to be a small fraction of the CCNPP Units 1 and 2 plume. Based on its relative distribution, the CCNPP Unit 3 plume will have little or no interaction with the CCNPP Units 1 and 2 plume. Its small cross sectional area is unlikely to provide a barrier to fish migration and its transient nature should limit attraction of fish such that they become acclimated and entrapped there, particularly during winter when fish are susceptible to cold shock from plant shutdown. Because fish are unlikely to become acclimated to the small plume, gas bubble disease should not occur. The potential for fish kills resulting from attraction of fish to the CCNPP Units 1 and 2 thermal plume was studied in 1987 with no winter fish kills observed during the period of the study.

Assuming that the benthic area is potentially exposed to the entire 3.6ºF (2ºC) isotherm, that area would be less than 0.7 acres (0.3 hectares), well within the State of Maryland regulatory criteria for benthic area affected, which in this case would be approximately 296 acres (120 hectares). In addition, since the plume is largely a surface phenomenon, benthic species are not likely to be affected.

It is concluded that the thermal impacts to aquatic communities will be minimal, and will not warrant mitigation.

Chemical Effects

Chemical effects of the discharge include the addition of biocides to limit fouling within the cooling water systems and other chemical agents to limit scaling in the CCNPP Unit 3 sewage treatment system. Discharge concentrations of these constituents will be limited by the Maryland State NPDES permit for the facility. Bioassay testing required by the NPDES permit will assess the potential toxicity of the discharge and provide for corrective action if necessary. To date, the testing performed for CCNPP Units 1 and 2 has not indicated any toxicity to test organisms. Similar results are expected during operation of CCNPP Unit 3. Chemical effects on aquatic biota will be minimal.

Physical Effects

Physical and related ecological impacts of the CCNPP Units 1 and 2 thermal discharge have been limited to sediment scour in the vicinity of the high velocity discharge ports. It is expected that the physical impacts associated with CCNPP Unit 3 will also be limited to sediment scour of a small area.

With CCNPP Units 1 and 2, the sand substrate present prior to station operation was scoured leaving a hard-pan clay substrate. The benthic community changed from one dominated by burrowing organisms to one dominated by fouling organisms. For CCNPP Unit 3, the same results are anticipated (i.e., recolonize with epibenthic organisms similar to those observed at the CCNPP Units 1 and 2 discharge).

Past studies at the CCNPP site area concluded that there were no effects of significance to food web interactions between benthic and finfish communities. Food web structure was similar at the reference site, suggesting that measurable changes in the benthic community had no impact on higher trophic levels. Thus, it is anticipated that there will be little or no ecological impact on the food base.

Several fish and invertebrate species that may occur within the CCNPP site area of the Chesapeake Bay have designated essential habitat or HAPC, or are otherwise protected. A review of the species listed in Table 6.6-3 having designated HAPC suggests that the small size of the thermal plume and its limited impact on substrate are unlikely to impact any life history stage of these species. In large measure, their presence in the CCNPP site area is transient. The dominant fish species found in the CCNPP site area have no designated HAPC. Of the species listed as threatened or endangered, occurrence in the CCNPP site area is rare.

Studies of finfish in the CCNPP site area were conducted from 1969 through 1981 using otter trawls towed monthly at three depths. The studies were designed to examine long-term trends including explanatory environmental variables. The three most abundant fish in trawls were the anchovy, spot, and croaker. Also common were white perch, winter flounder, hogchocker, and menhaden. The anchovy and spot were also common in impingement samples reflecting their local abundance. Annual and long-term changes in recruitment were explained by factors other than power plant operation.

The most common fish species fed on a combination of benthic organisms, zooplankton, and detritus. Their relative dominance in trawls increased over the study period, while those fish species that fed primarily on piscivores and mysids decreased. The loss of SAV in the area was given as a possible explanation for the decrease in fish that feed among vegetation. The loss of SAV was common throughout the Chesapeake Bay during the study period. In general, there were no strong positive or negative correlations among ecologically related groups that might indicate response to varying ecological conditions in the study area.

In addition, observations regarding the oyster, soft shell clam, and blue crab populations near the CCNPP Units 1 and 2 discharge have been documented. Settlement of oyster spat continued to occur in the discharge zone for CCNPP Units 1 and 2 during power plant operation. Young oysters were equally abundant there compared to other areas of the CCNPP site region. This has occurred despite the relocation of oysters from the discharge area to other areas prior to operation of CCNPP Units 1 and 2. Abundance and growth rates of the soft shell clam (*Mya arenaria*) were greater in the discharge area during plant operations compared to the pre-operational period. No effect on the blue crab was noted. Similar observations following the operation of CCNPP Unit 3 are expected.

It is concluded that the impacts to aquatic communities will be minimal, and will not warrant mitigation.

6.6.2.3 Transmission Facility Aquatic Impacts

The effects of transmission facility operation and maintenance on the aquatic ecosystems are considered in this section. The review evaluates the significance of these predicted impacts on important aquatic species and habitats, and evaluates alternative practices to mitigate the impacts, as needed.

Modifications to the offsite transmission facilities will be implemented within the existing substations. The CCNPP Unit 3 substation and transmission lines would be constructed in areas that, at present, are vegetated, contain delineated wetlands and have steep topography.

The new transmission lines will not cross over any onsite water bodies. At one point, the transmission corridor right-of-way is near Johns Creek. Transmission system operations and maintenance have the potential to cause impacts to water bodies and aquatic ecology.

Important Aquatic Species and Habitats

Surveys of benthic macroinvertebrates and fish were conducted and habitat quality assessed during September 2006 for the following potentially impacted water bodies:

- Two unnamed streams (Branch 1 and Branch 2) on the eastern side of the drainage divide, Branch 1 being downstream of the Camp Conoy fishing pond,
- Johns Creek, Branch 3 and Branch 4, and the unnamed headwater tributaries,
- Goldstein Branch,
- Laveel Branch,
- Camp Conoy fishing pond and two downstream impoundments,
- Lake Davies and two unnamed impoundment(s) within the Lake Davies dredge spoils disposal area, and
- Chesapeake Bay and Patuxent River.

No rare or unique aquatic species were identified in freshwater systems that might be impacted by the operation and maintenance of the transmission lines in the project vicinity. The aquatic species that are present onsite are ubiquitous, common, and easily located in nearby waters. Typical fish species include the eastern mosquitofish, bluegill, and the American eel. The most important aquatic invertebrate species in the impoundments and streams are the juvenile stages of flying insects.

No important aquatic habitats were identified in the freshwater systems in the project vicinity. One important species, because it is commercially harvested, is the American eel (*Anguilla rostrata*). It is found in most of the water bodies onsite and in the Chesapeake Bay. The American eel is abundant year round in all tributaries of the Chesapeake Bay.

Potential Impacts from Operation and Maintenance

The CCNPP site follows the standard industry practices for operation and maintenance of transmission line rights-of-way. Vegetation management is practiced to avoid any power outages and injury to the public and company employees from overgrown or diseased trees. Trees are pruned or cut, and integrated vegetation management performed, according to the relevant ANSI standards .

Regular inspections and maintenance of the transmission system and right-of-way corridors are performed. A patrol is performed twice annually of all transmission corridors, while more comprehensive inspections are performed on a rotating 5 year schedule. Maintenance is performed on an as-needed basis as dictated by the results of the line inspections.

Routine maintenance in and along the transmission corridor right-of-way requires cutting of herbaceous and low woody growth once a year, and cutting of saplings, larger shrubs and small trees once every five years. Herbicide applications are used only on an occasional basis, if at all. Access roads for construction and subsequent maintenance are stabilized wherever necessary with a course of stones to prevent formation of ruts and gullies in the exposed soil. These road surfaces will be allowed to grass over and will be cut only as necessary to maintain occasional vehicular access.

Increased runoff from 20 acres (8 hectares) of impervious surfaces from the switchyard could cause a modification to the hydrograph and increases in temperature, sediment and nutrients in receiving water bodies, and corresponding impacts to aquatic invertebrates, plants, and fish. Impacts from these effects would be mitigated by the provision of storm water retention facilities downstream. There is also the potential to increase stream temperatures from the removal of shade from ground and water bodies in the transmission corridor, but this is anticipated to be of minor significance.

Runoff of defoliants and herbicides could potentially contaminate water bodies and affect aquatic species. As previously noted, application of these chemicals is anticipated to be very infrequent and the impact, if any, would be temporary.

No access for recreation is permitted within the transmission system area, so no impacts to water-based recreational use are anticipated. Although the new transmission right-of-way will not cross over any water bodies, a portion does run near Johns Creek.

Because the transmission facilities are not proximal to the Chesapeake Bay, no direct impacts to the aquatic ecosystem in the Chesapeake Bay from transmission system operations are anticipated. Indirect impacts from increased heat and sediment flow in tributary streams may occur, but would be mitigated by storm water retention facilities.

The juvenile stages of flying insects readily recolonize available surface waters, and so would not be lost to the area from any intermittent operational impacts, such as transmission line maintenance. Species and other resources in the Chesapeake Bay are not anticipated to be adversely affected by transmission system operations.

Measures and Controls to Mitigate Potential Impacts

The bare soil exposed on transmission facility access roads will be rendered stable by covering it with a permeable cover of loose stone through which vegetation will be encouraged to grow to improve long-term post-construction stability. All other areas of disturbed soil will be similarly revegetated and maintained in such condition as a routine part of right-of-way management.

Biocides will be used sparingly if ever, in response to highly selective problems, and away from water, under the exclusive control of a licensed biocide applicator.

Small streams and wetlands in the right-of-way that are connected with water bodies containing fish, such as Johns Creek, will be maintained in as well-shaded a state as possible to minimize the warming effect of direct sunlight on surface water.

The only important aquatic species found near the new transmission facilities is the American eel in Johns Creek. Important species and habitats are found in the Chesapeake Bay; however, no adverse impacts to these species or habitats are anticipated from operation of the transmission facilities.

In summary, measures will be established such that sedimentation from transmission corridor access roads and the CCNPP Unit 3 substation will not reach Johns Creek. Accordingly, the operational and maintenance of the onsite transmission system is expected to have a minimal impact on the American eel, other fish species, and macroinvertebrates.

6.6.3 Effects On Wetlands

The impact on wetlands from construction activities is described in Section 5.6.3. There will be no additional impacts on wetlands from the operation of CCNPP Unit 3. In addition, CCNPP Unit 3 will be designed, constructed, operated, and maintained in accordance with NRC requirements, thus ensuring protection of life and property in the event of a flood, hurricane or other natural disaster. Implementation of the Spill Prevention, Control, and Countermeasures (SPCC) Plan and the Stormwater Pollution Prevention (SPP) Plan for CCNPP will minimize any additional impacts to the wetlands.

6.7 SOCIOECONOMIC IMPACTS OF OPERATION

6.7.1 Physical Impacts

The direct physical impacts from the operation of CCNPP Unit 3 include noise, odors, exhausts, thermal emissions, and visual intrusion. The discussion evaluates how these impacts should be treated and whether mitigation is needed. As a result of regulatory permits and controls and the remoteness of the site, direct physical impacts from plant operation on the surrounding community are expected to be minimal.

6.7.1.1 Plant Layout and Vicinity

Potential physical impacts will be controlled through compliance with applicable regulations and woodland screening. CCNPP Unit 3 will be located in a rural area, relatively remote from population and community centers. The site is also largely forested and situated between two other large forested tracts located to the north and south. Together, these tracts form one of the largest contiguous and predominantly undeveloped forested areas in the region.

6.7.1.2 Physical Impacts from Transmission Line Modifications

The new transmission lines and towers for CCNPP Unit 3 will be located entirely within the boundary of the CCNPP site; thus, no new corridors or widening of existing corridors is required. The onsite transmission lines are anticipated to cross over a construction road and laydown areas associated with the project. Because these lines are not expected to be constructed until the end of the project, exposure of the construction phase work force to field gradients will be minimal. Areas under the transmission lines will be cleared of any vegetation that might pose a safety threat. Any maintenance access roads are not anticipated to increase the public's exposure to electric field gradients. The anticipated re-establishment of native grasses and shrub vegetation, rather than tall trees, in the corridor will also limit wildlife exposure for smaller animal species.

Line Maintenance Practices

The use of pesticides and herbicides for vegetation control is described in the BGE transmission vegetation management program. The aim of the vegetation management program is to promote the safe and reliable transmission of electricity. The determination of appropriate chemical mixes, application methods, and rates will be made by a licensed pesticide applicator. All chemicals would be registered by the appropriate federal and state regulatory agencies. Special care will be exercised when working around streams, crops, lawns, and wetlands so as not to allow any chemical contact with these areas. A Regional Letter of Authorization to use herbicides in nontidal wetlands or waters has been authorized by the MDE, and compliance with the label requirements and the MDE regulations is required. Adherence to these policies and procedures will minimize any additional impacts to the ecosystem in the onsite transmission corridor. The rate of control of targeted vegetation is a minimum of 90% by span. Inspections to identify areas requiring herbicide treatments are performed annually.

Aircraft Visibility

The Federal Aviation Administration normally requires that structures that exceed a height of 200 ft (61 m) above ground level be marked and/or lighted for "increased conspicuity to ensure safety to air navigation." The transmission structures connecting the CCNPP Unit 3 substation with existing systems will be designed with sufficient height to eliminate impacts to personnel or equipment on the ground at the CCNPP site, but will be less than the 200 ft (61 m) criterion.

Helicopters, however, may land periodically at the CCNPP site, and the design of the transmission towers and lines will include lights and markers, where appropriate, to alert helicopter traffic to potential hazards created by the proposed structures. For example, lighting may be incorporated into tower design, and painted spherical markers may be attached to overhead lines for increased visibility to ensure air safety.

Aesthetic impacts are also considered in the design of the new transmission structures. Buildings and equipment will be painted to blend with the existing facilities and will not significantly increase the visual impact of the CCNPP site. While the new transmission towers will be of sufficient height to avoid safety impacts on the ground, the towers will not be excessively high such that aircraft safety is compromised or unnecessary visual impacts result from excessive tower height.

Electric Field Gradients

The maximum electric field gradients for the proposed transmission lines can be predicted through calculation. While there are no specific criteria for maximum electric field gradients, induced currents resulting from high electric fields created by overhead transmission lines are a concern and must be considered in the system design in accordance with NESC.

As part of the design process, the transmission lines will be analyzed to determine electrical-field strengths and to verify conformance with NESC requirements on line clearance to limit shock from induced currents. The minimum clearance to the ground, for lines having voltages exceeding 98 kV alternating current, must limit the potential induced current due to electrostatic effects to 5 milliamperes if the largest anticipated truck, vehicle, or other equipment were short-circuited to ground. For this determination, the NESC specifies that the lines be evaluated assuming a final unloaded sag at 120^{o}F (49^{o}C). The calculation is a two-step process in which the average field strength at 1.0 m (3.3 ft) above the ground beneath the minimum line clearance is calculated, and then the steady-state current value is determined. The 500 kV lines to be constructed between the CCNPP Unit 3 substation and the CCNPP Units 1 and 2 substation will be designed to meet the NESC.

Impacts to Communication Systems

Corona discharge from defective insulators or hardware is the principal cause of radio or television interference from transmission lines. Complaints on electromagnetic interference with radio or television reception have not been received on the lines running from the CCNPP site to the Waugh Chapel Substation and the Chalk Point Substation. Complaints that occur will be investigated for cause and, as necessary, defective components replaced to correct the problem. The existing CCNPP transmission lines are designed and constructed to minimize corona. The lines supporting CCNPP Unit 3 will also be designed and constructed to minimize corona. Accordingly, it is expected that radio and television interference from these new lines will be minimal.

Grounding Procedures for Stationary Objects

There are no new offsite lines and associated rights-of-way required for CCNPP Unit 3. The structures and equipment on the CCNPP site will be adequately grounded in the course of designing and constructing the proposed CCNPP Unit 3. No new offsite rights-of-way and associated grounding of stationary objects are required.

Electric Shock Potentials to Moving Vehicles

There is minimal potential for electric shock in moving vehicles such as buses or cars because the vehicles are insulated from ground by their rubber tires. As a result, occupants in cars and buses are generally safe from potential shock from overhead high voltage lines. In addition, because the vehicle is moving, there is little opportunity for the vehicle to become "capacitively charged" due to immersion in a transmission line's electrical field. In the unlikely event that a moving vehicle becomes charged, it is also unlikely that a grounded person outside the moving car or bus will touch the vehicle, thereby discharging a current through the person's body.

Noise Levels

Corona discharge is the electrical breakdown of air into charged particles caused by the electrical field at the surface of the conductors and is increased by ambient weather conditions such as humidity, air density, wind, and precipitation and by irregularities on the energized surfaces. During wet conditions, audible noise from the corona effect can exceed 50 dBA for a 500 kV line. Corona noise for a 500 kV line may range between 59 and 64 dBA during a worst case rain with heavy electrical loads. For reference, normal speech has a sound level of approximately 60 dBA and a bulldozer idles at approximately 85 dBA.

CCNPP transmission lines are designed and constructed with hardware and conductors that have features to eliminate corona discharge. Nevertheless, during wet weather, the potential for corona discharge increases, and nuisance noise could occur if insulators or other hardware have any defects. Corona-induced noise along the existing transmission lines is very low or inaudible, except possibly directly below the line on a quiet, humid day. Such noise does not pose a risk to humans. Complaints of transmission line noise are monitored but reports of nuisance noise have not been received from members of the public.

The substations onsite include transformer banks and circuit breakers that create "hum," normally around 60 dBA, and occasional instantaneous sounds in the range of 70 to 90 dBA during activation of circuit breakers. The proposed CCNPP Unit 3 substation will introduce these new noise sources (transformers and circuit breakers) to its location. The noise levels surrounding the substation would likely be close to 60 dBA near the substation fence, but will be significantly reduced near the site boundary, approximately 2,800 ft (850 m) to the south. For the purpose of this assessment, compliance with the maximum allowable day and night noise levels of 65 and 55 dBA, respectively, in accordance with Maryland regulations, is deemed adequate to achieve environmental noise acceptance.

Thermophilic Microorganism Impacts

One concern is the potential for growth and release of thermophilic organisms. These thermally enhanced microorganisms have been linked to plants that use cooling ponds, lakes, or canals that discharge to small rivers. Elevated temperatures within cooling tower systems are known to promote the growth of thermophilic bacteria, including the enteric pathogens Salmonella sp. and Shigella sp., as well as *Pseudomonas aeruginosa* and fungi. The bacteria Legionella and the amoebae Naegleria and Acanthamoeba have also been found in these systems. Each of these can have health consequences. The Centers for Disease Control and Prevention (CDC) maintains records of outbreaks of waterborne diseases and reported 16 cases of Legionella sp. infection in Maryland between 2002 and 2004, all associated with drinking water. The presence of the amoeba N. fowleri in fresh water bodies adjacent to power plants has also been identified as a potential health issue linked to thermal discharges.

At CCNPP Unit 3, water temperature entering the CWS cooling tower is designed to be approximately 10ºF (5.5ºC) above ambient, makeup water withdrawn from the Chesapeake Bay, which might be an attractive temperature differential for these organisms. Thermophilic organisms are typically associated with fresh water and the saline content of the makeup water will discourage their growth. In the vicinity of the CCNPP site the Chesapeake Bay is mesohaline, with salinities ranging from 5 to 18 parts per thousand. In addition, biocide treatment of the inlet water should minimize the propagation of micro-organisms. As a result, pathogenic thermophilic organisms are not expected to propagate within the CCNPP Unit 3 condenser cooling tower system and should not create a public health issue.

Normal makeup water for the ESWS and mechanical draft towers will be supplied by a Desalination Plant. The ESWS cooling towers will require approximately 1,082 gpm (7,124 lpm) of makeup water. Of this, approximately 540 gpm (3,558 lpm) will be used in blowdown. Biocide treatment of water in the ESWS will limit the propagation of thermophilic organisms. ESWS blowdown will combine with the saline discharge from the CWS cooling tower prior to its discharge to the Chesapeake Bay.

All biocides will be stored and used in accordance with federal, state, and local regulations. Potential health impacts to workers from routine maintenance activities associated with the towers will be controlled through the application of industrial hygiene practices including the use of appropriate personal protective equipment.

It is concluded that the risk to public health from thermophilic microorganisms will be minimal and will not warrant mitigation beyond the use of biocide treatment of the condenser cooling and service water systems and implementation of appropriate industrial hygiene practices.

6.7.2 Socioeconomic Impacts

This section describes the potential demographic, housing, employment and income, tax revenue generation, land value, and public facilities and services impacts of station operations. The comparative geographic area for the evaluation of socioeconomic impacts extends in a 50 mi (80 km) radius from the proposed CCNPP Unit 3 power plant. Calvert and St. Mary's Counties have been defined as the primary area of concern for socioeconomic impact since 91% of the existing CCNPP Units 1 and 2 operational workforce resides there, and it is assumed that the operational workforce for CCNPP Unit 3 would also primarily reside in and impact this geographic area.

The impact evaluation assumes that the residences of CCNPP Unit 3 employees will be distributed across the region in the same proportion as those of the CCNPP Units 1 and 2 employees. It is estimated that an additional operational work force of 363 onsite employees will be needed for CCNPP Unit 3. Approximately 91% (330) of the new employees are expected to settle in Calvert and St. Mary's

Counties. Sixty-seven percent (562) of current CCNPP Units 1 and 2 employees live in Calvert County. A total of 1,424 people would migrate into the two-county area, representing a 0.89% increase in the total of 160,774 people.

The area is rural, with utilities and amenities generally supplied by the townships in the county. It is likely that the new employees who choose to settle near the CCNPP site will purchase homes in the Calvert County and St. Mary's County area. Based on the 30 years of experience of the existing units, increased tax revenues will not spur development in the vicinity of the CCNPP site. A portion of the land within the vicinity of CCNPP in Calvert County and St. Mary's County is owned by the Federal government and is unavailable for development.

The total population within 1 mi (1.6 km) of the site is 30, with no residential properties located within the CCNPP site boundary. Within 2 mi (3.2 km), the total population is less than 2,500. Portions of the towns of Lusby and Calvert Beach are within 2 mi (3.2 km) of the CCNPP site. Besides the residential or farm buildings in the surrounding community, there is an elementary school approximately 2 mi (3.2 km) from the CCNPP site. The Town of Lusby located southwest of the CCNPP site has commercial buildings in the town center. Economic development plans include expanding and improving the town center and developing a nearby business park.

Recreational facilities in the immediate area around the CCNPP site are Flag Ponds Park to the north and Calvert Cliffs State Park to the south.

6.7.2.1 Demography

<u>50 mi (80 km) Comparative Geographic Area</u>

The operational workforce would likely be hired from throughout the east coast and from major population centers in the study area, including the Washington, D.C. area to the northwest of the CCNPP site; the Lexington Park, Maryland area to the south; and the cities of Alexandria, Virginia, Annapolis, Maryland, and Baltimore, Maryland. Some of the operational workforce is likely to be drawn from the construction workforce, which would either remain residents in the two-county area or would permanently move to the two-county area.

<u>Two-County Area</u>

As previously stated, 91% of the existing CCNPP Units 1 and 2 operational workforce resides in Calvert County and St. Mary's County. It is assumed that the direct and indirect operational workforce for CCNPP Unit 3 would also be permanent in-migrants primarily residing in and impacting this geographic area.

An additional workforce of up to 1,000 workers may be required for a 15-day period, once every 18 months, to support planned plant outages during refueling and other specialized tasks. This group likely would represent only temporary visitors to the area and would commute either on a weekly basis or for the duration of the tasks, and would reside in area hotels and motels. The scheduled outage for CCNPP Unit 3 would be planned around similar schedules for CCNPP Units 1 and 2, so that they do not overlap.

Because of the relatively small size of the CCNPP Unit 3 operational workforce, the changes in population within the two-county area would not be significant.

Housing

The construction workforce would be significantly larger than the operational workforce. Construction would be of sufficient duration that the housing and support services required during CCNPP Unit 3 operation would already be in place so that any incremental CCNPP Unit 3 operational impacts would be minimal. The operational workforce would either rent or purchase existing homes in the two-county area, or would purchase acreage on which to build new homes. Of the estimated 545 direct and indirect households migrating into the two-county area as a result of operating CCNPP Unit 3, it is estimated that 410 households (75%) would reside in Calvert County and 135 (25%) would reside in St. Mary's County. The total number of housing units needed within the two-county area would represent 9.8% of the total 5,568 vacant units located in the two-county area in 2000.

In addition, scheduling planned outages for CCNPP Unit 3 at times other than when they would occur for CCNPP Units 1 and 2 should minimize the impacts of the availability and cost for hotel/motel rooms and other short-term accommodations.

Thus, the overall two-county area and each county within it have enough housing units available to meet the needs of the workforce. Because significantly more units are available than would be needed, the in-migrating workforces alone should not result in an increase in housing prices or rental rates. Thus, it is concluded that the impacts to area housing would not be significant or warrant mitigation.

Employment and Income

An estimated 363 direct employees would be added to the onsite workforce to operate CCNPP Unit 3, and a maximum of 661 indirect job opportunities would be created in the two-county area. As stated above, of this total an estimated 330 direct workers (91%) and 661 indirect workers would reside within the Calvert and St. Mary's Counties. The 991 direct and indirect two-county area jobs would result in a noticeable but small impact to the area economy, representing a 1.1% increase in the two-county labor force of 85,373, consisting of 39,341 total labor force in Calvert County in 2000 and the 46,032 total labor force in St. Mary's County.

It is estimated that the owner/operator would spend $28 million annually on salaries (in 2005 dollars, an average of $77,135/year/worker for direct labor, excluding benefits). The CCNPP Unit 3 estimated average annual salary is only somewhat less than the $84,388 median income for an entire household in Calvert County in 2005, but noticeably larger than $62,939 median household income in St. Mary's County. If income is distributed similarly to the population in-migration, Calvert County would experience an estimated $19.0 million increase in annual income and St. Mary's County would receive an estimated $6.4 million annually.

Assuming that the indirect workforce would have annual salaries of $84,388 (based on the 2005 median household income in Calvert County), the 408 indirect households migrating into Calvert County would generate over $34.4 million in income and the 137 indirect households in St. Mary's County would generate $11.6 million in household income. This additional income would result in additional expenditures and economic activity in the two-county area. However, it would represent a small percentage of overall total income in the two-county area It is concluded that the impacts to employment and income would be minimal and would not require mitigation.

Land Values

A Maryland Department of Natural Resources study of the effects of large industrial facilities showed that residential property values have not been adversely affected by their proximity to the CCNPP site.

Overall, Maryland power plants have not been observed to have negative impacts on surrounding property values.

Other studies of potential impacts to property values have had varied results, depending on the type of facility being studied, including facilities that are more visible and could have greater risks such as nuclear power plants, facilities that are potentially less visible but also have greater risks such as landfills and hazardous waste sites, and highly visible facilities but with potentially less perceived risk such as electrical transmission lines and windfarm facilities. For instance, studies of the property value impacts of the Three Mile Island nuclear power plant accident showed that nearby residences were not significantly affected by the accident. However, studies of the impacts to residential property values from low-level radioactive waste landfills in Ohio, from leaks at a nuclear facility in Ohio, and along potential nuclear shipment routes in Nevada show that these facilities and activities have a negative impact on housing values within a limited distance from the facility, typically within 3 miles. Even within this limited distance, the impacts on property values decrease rather quickly with increased distance from the facility.

Evaluations of potentially less visible but also perceived greater risk facilities such as hazardous waste and Superfund sites (e.g., underground storage tanks, existing and former manufacturing facilities, and so forth) generally show similar results. A study of underground storage tanks in Ohio showed that proximity to non-leaking or unregistered leaking tanks did not affect property values, but registered leaking tanks affected property values within 300 ft of the sites. Studies of Superfund sites in Ohio, Texas, Pennsylvania, and the southeastern United States showed that property values were negatively affected by the facilities. The negative impacts were particularly noticeable during periods with significant media coverage and public concern, with the properties close to the facilities most affected. Again, the grater the distance from the facilities, the smaller the impacts on property values. Also, once there was a smaller reduction in media attention and public concern, or after site cleanup, property values sometimes recovered from their losses.

Electrical transmission lines and windfarm facilities can be highly visible but might have a smaller perceived risk to area residents than nuclear and hazardous waste facilities. Although three early studies found that tall electrical transmission lines did not affect nearby residential or agricultural property values, later studies showed that they did have a negative effect on property values. The most common reason given by one study was the visual impact of the transmission line, followed by the perceived health risk. One study showed that over time the negative impacts to property values decreased, indicating a reduced concern about the facilities. Studies of potential impacts to property values from windfarm facilities have had mixed results. A study of an existing windfarm in New York and a potential windfarm facility in Illinois showed that there was no impact to nearby residential property values. However, another study of impacts at existing facilities showed that property values increased faster near the facilities than in control areas, likely because of the perception that they represented "green" benefits to the environment.

Overall, these studies show that the impacts of various types of facilities can have a negative impact on residential property values, typically within 1 to 3 miles of a facility. However, they also show that the impacts might be less where other facilities already exist, and over time these negative impacts could decrease. Because there is an existing nuclear power plant at the Calvert Cliffs site, it has been there for a number of years, it is not highly visible to area residents or recreational users, and most residents are located over a mile away from the site, the impacts to land values likely would be minimal and not require mitigation.

6.7.2.2 Tax Revenue Generation

THIS SECTION CONTAINS CONFIDENTIAL COMMERCIAL AND FINANCIAL INFORMATION THAT HAS BEEN REDACTED FROM THE TECHNICAL REPORT AND HAS BEEN SUBMITTED SEPARATELY TO THE PUBLIC SERVICE COMMISSION UNDER SEAL

6.7.2.3 Public Facilities and Services

Public Facilities

The excess capacity of housing and public facilities in the two-county area would result in enough public facility capacity to meet the direct operational workforce needs. As discussed above, there is a sufficient quantity of vacant housing units in Calvert and St. Mary's Counties to meet the housing needs of the in-migrating direct and indirect operational workforces for CCNPP Unit 3, so no new housing units would likely be required. Thus, water and sewage services would not be affected and would continue to be adequate to meet the needs of the workforces. Although an increase in the population would likely place additional demands on area transportation and recreational facilities, the facilities appear to have enough capacity to accommodate the increased demand and impacts are not expected to be significant. Area highways and roads would have increased traffic levels, particularly during shift changes at the CCNPP, resulting in a minor traffic impact.

Public Services

Although an increase in population levels from the CCNPP operational workforces would likely place additional demands on area doctors and hospitals, these services have enough capacity to accommodate the increased demand and impacts would likely be small. Although the increased population levels would likely place additional daily demands on constrained police services, fire suppression and EMS services, and schools, those agencies have indicated that additional demands from the power plant would be easily addressed. The agencies indicated that the additional demands would not reach a level where action would have to be taken, or where mitigation would be required.

Police, EMS, and Fire Suppression Services

Calvert County and St. Mary's County have large volunteer fire departments that are meeting the needs of their respective residents. These fire and emergency response departments are supplemented by the CCNPP's onsite emergency response team, which includes a fire brigade. The CCNPP Unit 3 staff will include an onsite emergency response team staff, a fire brigade and emergency medical technician (EMT) responders. A new emergency management plan will be developed for CCNPP Unit 3, similar to that already existing for CCNPP Units 1 and 2, that would address UNE and UNO and agency responsibilities, reporting procedures, actions to be taken, and other items should an emergency occur at CCNPP Unit 3.

Educational System

As described above, an estimated 408 new households will move to Calvert County. The expected increased property taxes for CCNPP Unit 3 will provide additional funds to meet the educational needs of

children of the new operational workforce. Although increased funding would be derived from county property taxes, it would also result in decreased funds from the State of Maryland. For fiscal year 2006, the state provided $64.7 million (42.5% of total revenues) in funds to the school district and Calvert

County provided $85.7 million (56.2%). The State's current funding formula is based on allocating a set amount of revenues across all school districts based upon enrollment levels and the amount of funds they derive from other sources. This process requires several iterations of exchanging information and finalizing enrollments and other funding levels before the State makes its final allocations in January or February of the school year. Thus, this occurs well after teachers and staff have already been hired and the school districts have begun making expenditures. In addition, Calvert County School District does not have a set property tax rate, as exists for school districts in some states, from which to project its annual budget. Instead, they have discussions with the County at the beginning of each school year to determine what funding the County will be providing. A number of factors also enter into the decisionmaking about what funds the County will allocate. Thus, because the funding from the State and the County are variable each year, it is not possible to calculate how much increased property taxes from CCNPP Unit 3 might result in reduced state funding levels to the District. However, because of the significant increase in County property taxes from the project, it is concluded that the net impacts to the Calvert County Public School System would be small.

The educational facilities in St. Mary's County Public School System already are operating near capacity. The in-migration of an estimated 137 new households into the county from operation of the CCNPP Unit 3 would place greater demands on the system. Although the school district could receive some additional funding from property taxes generated by these new households (likely to be minimal because adequate housing units are already available in the county and those units are already being taxed), it would not receive additional funding directly from the power plant because CCNPP Unit 3 does not pay property taxes to St. Mary's County. Because the number of in-migrating operational households is small and the educational system already would likely have been expanded to meet the in-migrating construction workforce needs, the impacts of the power plant on the St. Mary's County School District would likely be small.

Traffic Impacts

The completed traffic impact analysis (TIA) showed, in part, that the conditions during CCNPP Unit 3 operation have no significant additional effect on the operating level of service at the intersections along MD 2/4 and, therefore, further mitigation is not required. The TIA conclusion, however, is based on the assumption that the anticipated future traffic growth rate will require placement of signals at two intersections along MD 2/4 near the CCNPP site that are presently without signals. Thus, the impact from traffic due to operation of the new unit on nearby residences and recreational areas is anticipated to be minimal.

Visual Intrusion

CCNPP Unit 3 will not be generally visible at ground level from points north, south, and west of the CCNPP site boundary due to the heavily wooded areas surrounding the site area. Similarly, recreational users of the Chesapeake Bay to the east generally will be unable to view most of CCNPP Unit 3 due to its elevation above the water and the setback from the shoreline.

The intake and discharge structures will be visible from the Chesapeake Bay, as they will be located along the shoreline near existing CCNPP Units 1 and 2 structures. The upper portions of the CCNPP Unit 3 containment and cooling tower may also be visible from certain portions of the Chesapeake Bay due to their heights above grade. The impact of these visual intrusions, however, is expected to be minimal because the CCNPP site is already aesthetically altered by the presence of the existing CCNPP Units 1 and 2 structures. No additional landscaping is necessary.

6.8 OPERATION NOISE

The principal noise sources associated with operation of the new plant are the switchyard, transformers, and cooling tower. Recent baseline ambient noise surveys document that there is no observed, offsite, audible noise from the existing plant, day or night over a two-day period, although both units were operating continuously. Similar results can be expected for CCNPP Unit 3, as it relates to general plant noise, including the switchyard and transformers. An added impact due to cooling tower noise, however, would be expected because CCNPP Units 1 and 2 use an open-cycle heat dissipation system and do not have cooling towers.

The operation of the CWS cooling towers and plume abatement system for CCNPP Unit 3 will generate additional noise. MDE's noise level standards for a residence are 65 dBA during daytime and 55 dBA during evening. The State of Maryland's environmental goals are 70 dBA for industrial zoned districts (expressed as a 24-hour equivalent sound level), 64 dBA and 55 dBA for commercial and residential zoned districts (expressed as the 24-hour day-night average sound level, with a 10 decibel penalty applied to noise occurring during the nighttime period (COMAR 26.02.03)). U.S. EPA developed human health noise guidelines to protect against hearing loss and annoyance and established an outdoor activity guideline of 55 dBA.

The estimated noise generated from the CCNPP Unit 3 cooling tower operation has been modeled to assess the impact to the nearby community. Figures 6.8-1 and 6.8-2 show the estimated sound contours from the anticipated cooling tower noise during the summer leaf-on season and the winter leaf-off season. As illustrated, the sound levels beyond the CCNPP site boundary, regardless of the season, are below both the daytime and nighttime maximum allowable levels of 65 db(A) and 55 db(A), respectively. Thus, the impact from noise due to operation of the CWS cooling tower on nearby residences and recreational areas is anticipated to be minimal.

Noise generated from traffic will increase due to a larger plant workforce and more CCNPP site deliveries and offsite shipments. The traffic noise, however, will be limited to normal weekday business hours. In addition, traffic control and administrative measures such as staggered shift hours will diminish traffic noise during the weekday business hours. Traffic noise during evenings and weekends will be substantially reduced, as only a small fraction of the weekday workforce will be onsite. The potential noise impacts to the community, therefore, are expected to be temporary, during shift change, and manageable. Thus, the impact from traffic noise due to operation of the new unit on nearby residences and recreational areas is anticipated to be minimal.

6.9 DISPOSAL OF PLANT-GENERATED SOLID AND HAZARDOUS WASTES

The types of solid wastes that are expected to be generated by CCNPP Unit 3 include hazardous waste, mixed wastes, cooling water intake debris, trash, and solid wastes. These wastes generated by operation of CCNPP Unit 3 will be managed in accordance with applicable federal, state, and local laws, regulations, and permit requirements. Management practices will be similar to, if not the same as, those implemented for CCNPP Units 1 and 2.

6.9.1 Solid Wastes

It is expected that CCNPP Unit 3 will generate similar, minimal volumes of solid waste to that created by Units 1 and 2. Unit 3's solid waste will be handled as follows:

- Non-radioactive solid wastes (e.g., office wastes, recyclables) will be collected temporarily on the CCNPP site and disposed of at offsite, licensed disposal and recycling facilities.

- Debris (e.g., vegetation, aquatic fish, and invertebrates) collected on trash racks and screens at the water intake structure will be disposed of as solid waste in accordance with the applicable NPDES permit.

- Scrap metal, used oil, and antifreeze (ethylene or propylene glycol) will be collected and stored temporarily on the CCNPP site and recycled or recovered at an offsite permitted recycling or recovery facility, as appropriate. Used oil and antifreeze are not controlled hazardous substances in Maryland unless they have been combined or mixed with characteristic or listed hazardous wastes. Typically, used oil and antifreeze will be recycled. If not, they will be disposed of as solid waste in accordance with the applicable regulations.

- Sewage sludge will be transported to a permitted offsite waste treatment plant for disposal.

6.9.2 Hazardous Wastes

Hazardous wastes are materials with properties that make them dangerous or potentially harmful to human health or the environment, or that exhibit at least one of the following characteristics: ignitability, corrosivity, reactivity, or toxicity. Federal Resource Conservation and Recovery Act regulations govern the generation, treatment, storage, and disposal of hazardous wastes. Hazardous waste is defined as any solid, liquid, or gaseous waste that is not mixed waste, is listed as hazardous by any federal or state regulatory agency, or meets the criteria of Subpart D of 40 CFR 261or COMAR 26.13.02.

A Hazardous Waste Minimization Plan will be developed and maintained that documents the current and planned efforts to reduce the amount or toxicity of the hazardous waste to be generated at CCNPP Unit 3. Hazardous wastes will be collected and stored in a controlled access temporary storage area (TSA). A Hazardous Material and Oil Spill Response guideline will be maintained that defines HAZMAT team positions and duties. Procedures will be put in place to minimize the impact of any hazardous waste spills in the unlikely event of a spill. Containers of known hazardous waste received at a TSA will be transported offsite within 90 days of the containers' accumulation date according to the applicable section/unit procedures. The Radiation Protection and Chemistry Manager will manage hazardous wastes using plant procedures to be developed in the future, but that will comply with all applicable federal, state, and local regulation.

Table 6.9-1 lists the types and quantities of hazardous waste, including universal waste, generated at CCNPP Units 1 and 2. The table is based on the CCNPP biennial hazardous waste reports submitted to the MDE for 2001, 2003, and 2005. The quantity of hazardous wastes generated at CCNPP Unit 3 is expected to be similar to or less than that at CCNPP Units 1 and 2.

6.9.3 Mixed Wastes

Mixed waste contains hazardous waste and a low level radioactive source, special nuclear material, or byproduct material. Currently, CCNPP manages mixed waste at CCNPP Units 1 and 2 in accordance with a Memorandum of Understanding (MOU) with MDE (Amended MOU – Mixed Wastes at Calvert Cliffs Nuclear Power Plant, Constellation Generation Group LLC to Maryland Department of

Environment, November 12, 2002). The MOU is patterned after the U.S. EPA August, 1991 Mixed Waste Enforcement Policy.

Nuclear power plants, in general, are not significant generators of mixed waste, with quantities accounting for less than 3% of the annual low level radioactive waste generated (NRC, 1996). Typical types of mixed waste generated include:

- Waste oil from pumps and other equipment.
- Chlorinated fluorocarbons resulting from cleaning, refrigeration, degreasing, and decontamination activities.
- Organic solvents, reagents, and compounds, and associated materials such as rags and wipes.
- Metals such as lead from shielding applications and chromium from solutions and acids.
- Metal-contaminated organic sludges and other chemicals.
- Aqueous corrosives consisting of organic and inorganic acids.

Mixed waste generation at CCNPP Units 1 and 2, in particular, is very limited. For example, the last mixed waste shipment was in 2004, which included one 55 gallon (208 liter) drum. Prior to that, the previous mixed waste shipment was in 1999.

Based on the size of CCNPP Unit 3 compared to CCNPP Units 1 and 2, the types and quantities of mixed waste generation are anticipated to be equal to or less than CCNPP Units 1 and 2. As a result, the potential impacts will be the same or less, i.e., minimal. The small quantities of mixed waste will be temporarily stored onsite, similar to CCNPP Units 1 and 2, and then shipped for treatment and disposal to an offsite permitted facility.

6.9.4 Temporary Storage and Disposal of Radioactive Waste

The temporary storage and disposal of high level nuclear waste, including spent fuel, is governed by the Federal Department of Energy. For informational purposes only, Appendix D, entitled "Temporary Storage/Disposition and Impact of Spent Fuel and Low-Level Radioactive Waste," is attached.

Table 6.9-1 Biennial Hazardous Waste Management
CCNPP Units 1 and 2

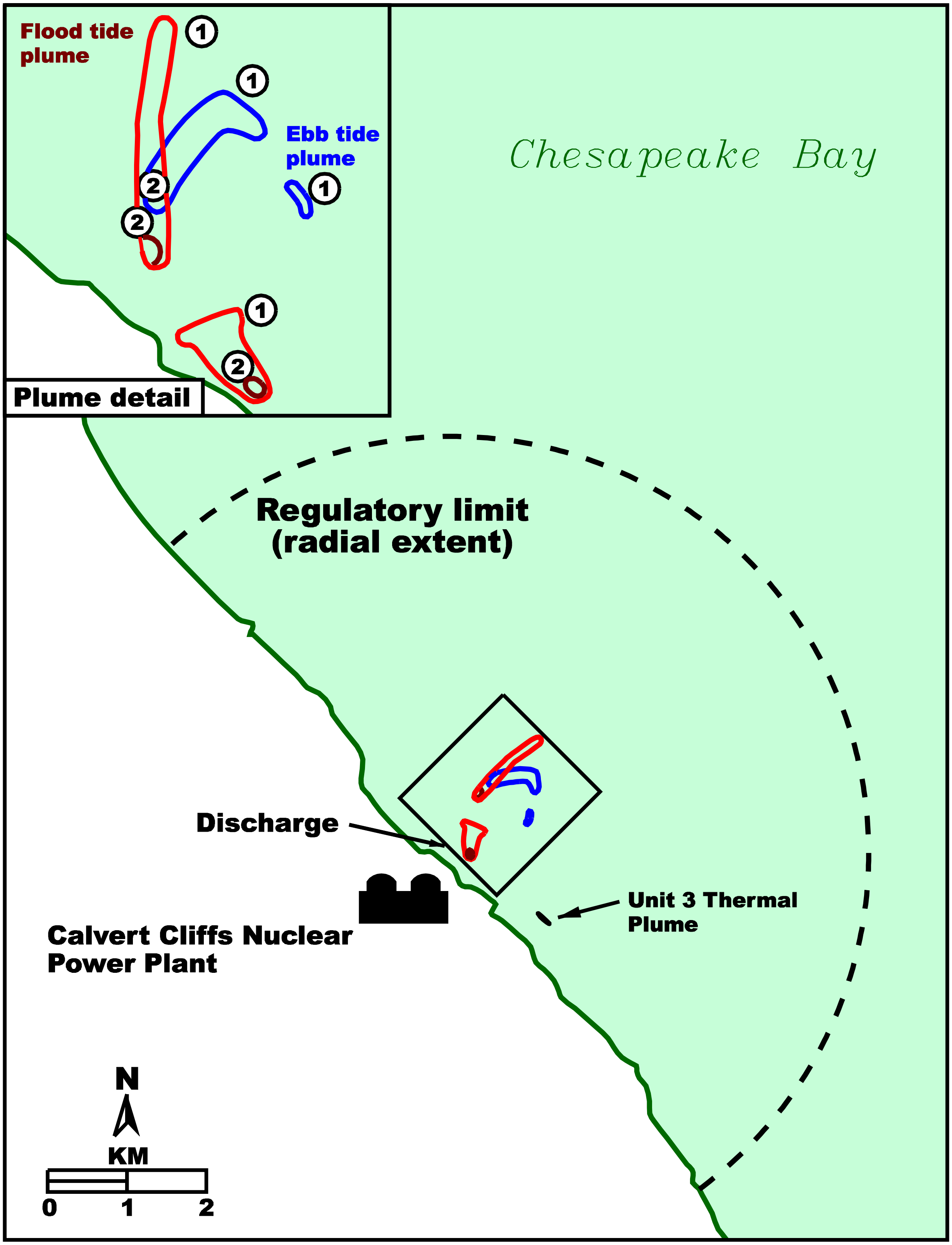
Hazardous Waste	Year/Quantity (lbs/kg)					
	2001		2003		2005	
	(lbs)	*(kg)*	*(lbs)*	*(kg)*	*(lbs)*	*(kg)*
Sulfuric Acid	840	381	0	0	0	0
Ammonium Hydroxide (lead solution)	80	36	0	0	0	0
Epoxy Adhesive/Coatings	10	5	0	0	522	237
Hydrazine	1	0.5	0	0	0	0

Hazardous Waste	Year/Quantity (lbs/kg)					
	2001		2003		2005	
	(lbs)	*(kg)*	*(lbs)*	*(kg)*	*(lbs)*	*(kg)*
Corrosive Liquids	161	73	0	0	0	0
Mercury-filled Equipment	5	2	0	0	15	7
Used Oil (with solvents)	1,200	544	0	0	0	0
Paint	4,320	1,960	2,320	1,052	5,115	2,320
PCB Capacitors	4	2	0	0	0	0
PCB Light Ballasts	20	9	11	5	0	0
Flammable Liquid	0	0	800	363	0	0
Compressed Gases	0	0	30	14	0	0
Lab Pack Chemicals (flammable)	0	0	200	91	253	115
Lab Pack Chemicals (toxic)	0	0	80	36	0	0
Aqueous Ammonia Solution	0	0	0	0	6,000	2,722
Activated Carbon	0	0	0	0	1	0.5
Lead (debris)	0	0	0	0	150	68
Butane	0	0	0	0	2	1
Propane	0	0	0	0	4	0.9
Total	6,641	3,012.5	3,441	1,561	12,062	5,471.4

Key:
(lbs) – pounds
(kg) - kilogram

Minimal environmental impacts would result from storage or shipment of mixed wastes. In the event of a spill, emergency procedures would be implemented to limit any onsite impacts. Emergency response personnel would be properly trained and would maintain a current facility inventory, which would include types of waste, volumes, locations, hazards, control measures, and precautionary measures to be taken in the event of a spill.

945997.6



Note:
This figure shows the Unit 3 Thermal Plume Predictions Compared to CCNPP Units 1 and 2 Historical Predictions: The CCNPP Units 1 and 2 plume is shown in the box insert. The CCNPP Unit 3 predicted plume is shown South of the plant.

FIGURE 6.4-1 **Rev. 0**

CCNPP UNIT 3 THERMAL PLUME PREDICTIONS

CCNPP UNIT 3 CPCN

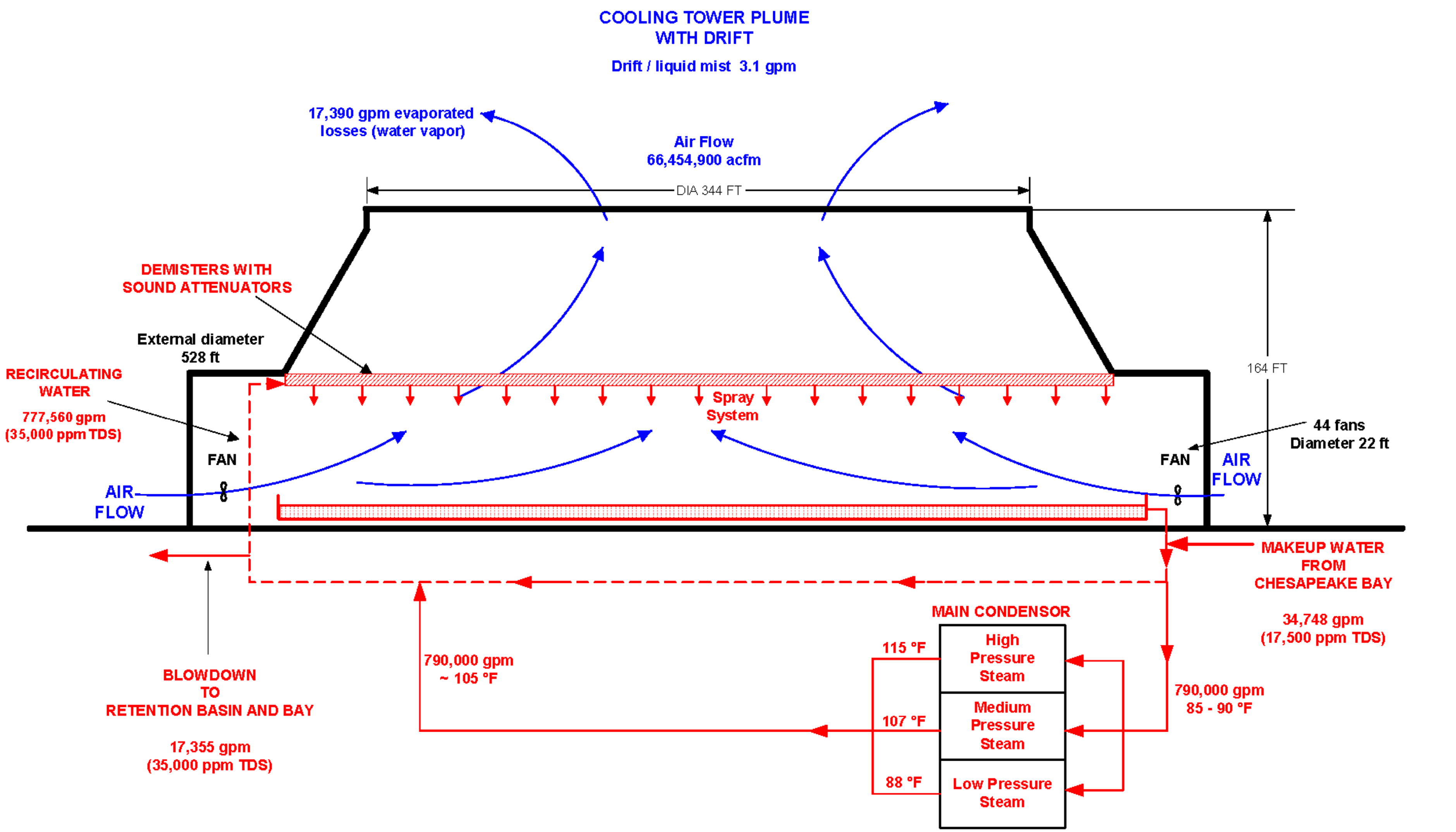


FIGURE 6.5-1 **Rev. 0**

SCHEMATIC OF CWS COOLING TOWER ELEVATION VIEW

CCNPP UNIT 3 CPCN

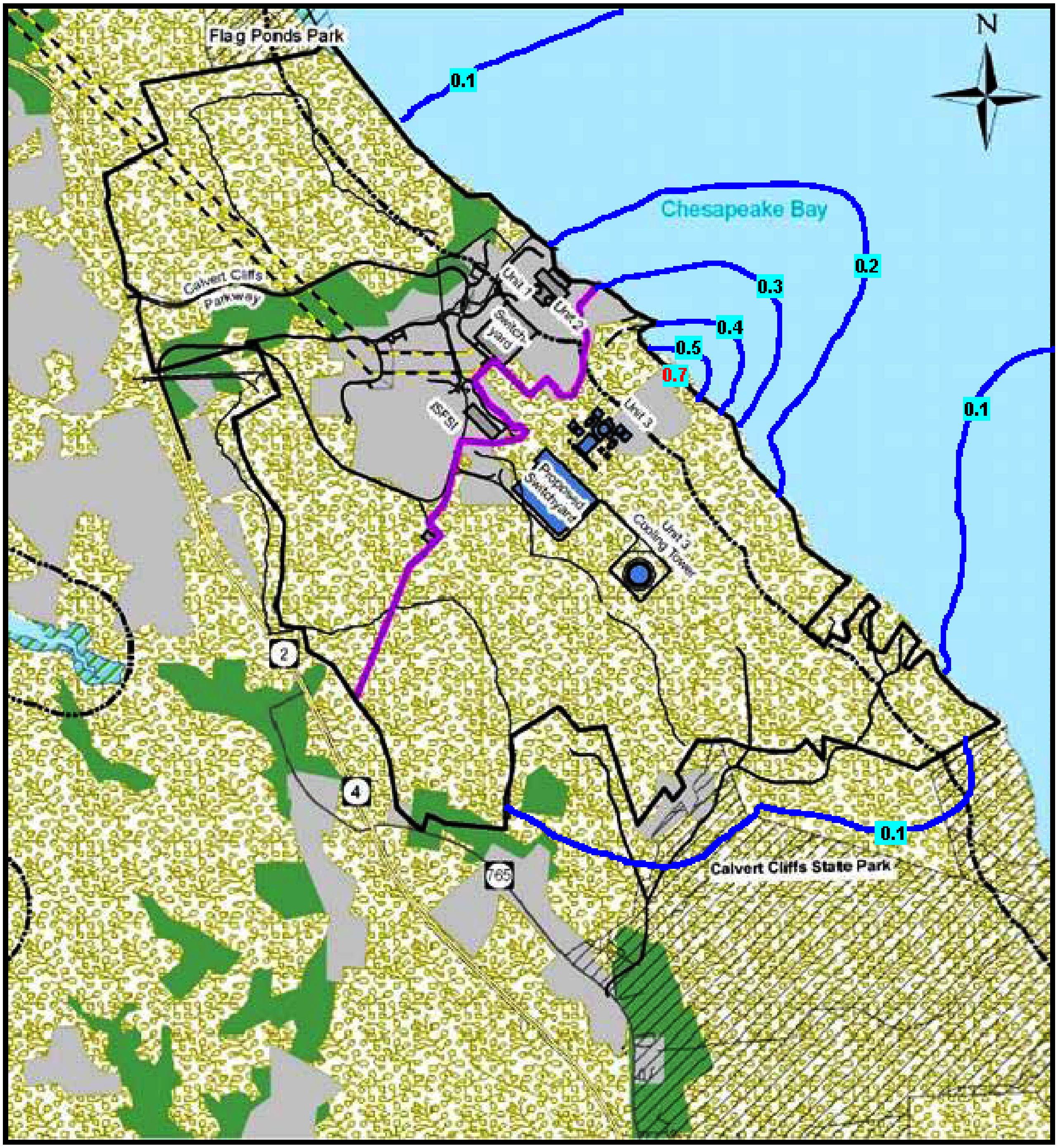


FIGURE 6.5-2 **Rev. 0**

HIGHEST MODELED ANNUAL AVERAGE PM−10 IMPACTS ($\mu g/m^3$)

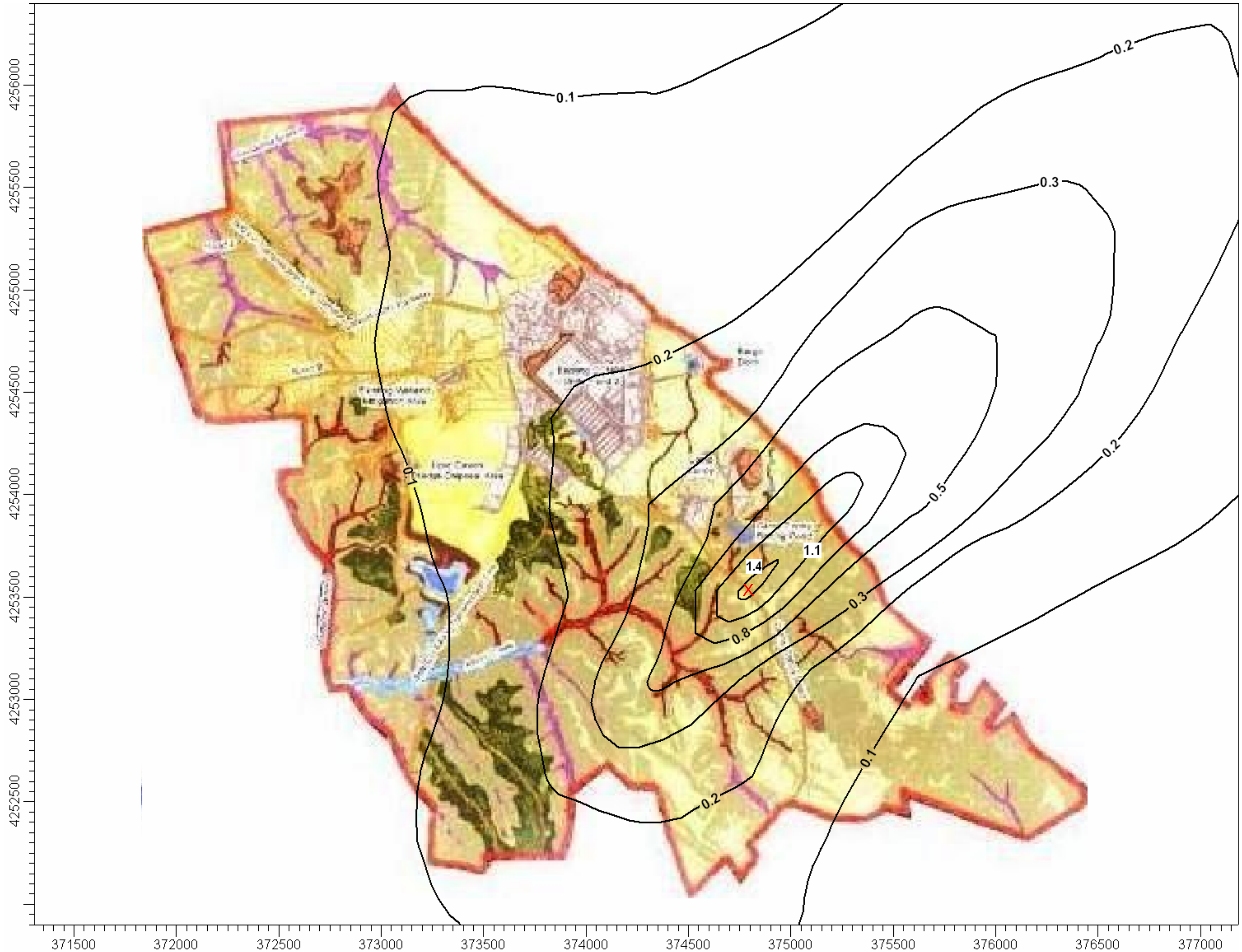
CCNPP UNIT 3 CPCN

Maximum Impact Shown in Red

FIGURE 6.5-3 **Rev. 0**

HIGHEST MODELED 24–HOUR AVERAGE PM–10 IMPACTS

CCNPP UNIT 3 CPCN



X = Max Deposition Rate (2.1 lb/acre/month)

Figure 6.6-1 CCNPP Site – Maximum Salt Drift Deposition Rates (lb/acre/month)

● Designates Measurement locations.

0 800 1600 2400
SCALE: FEET

0 250 500 750 1000
SCALE: METERS

FIGURE 6.8-1 Rev. 0

PREDICTED SOUND CONTOURS (dBA)
OF HYBRID COOLING TOWER
DURING LEAF-ON CONDITIONS

CCNPP UNIT 3 CPCN

● Designates Measurement locations.

0 800 1600 2400 SCALE: FEET

0 250 500 750 1000 SCALE: METERS

FIGURE 6.8-2 Rev. 0

PREDICTED SOUND CONTOURS (dBA)
OF HYBRID COOLING TOWER
UNDER LEAF-OFF CONDITIONS

CCNPP UNIT 3 CPCN