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6.0 MEASURING AND MONITORING

6.1 THERMAL MONITORING

{This section presents the preapplication, preoperational, and operational thermal monitoring programs for the CCNPP) Unit 3. The objective of thermal monitoring during each phase is to comply with Federal and State water quality criteria and to protect aquatic life within the area of influence of the facility.

Pertinent CCNPP site and plant features, including boundaries and bathymetry of all water bodies adjacent to the site are described and shown in Section 2.3.1. The existing thermal monitoring stations are shown in Figure 6.1-1. Additional information related to field water temperature measurement and data analysis is described in Section 2.3.1. Hydrological and biological monitoring are described in Section 6.3 and Section 6.5. The extent of the predicted thermal plume is described in Section 5.3.2.1.

Temperature monitoring is described in each subsection below corresponding with the preapplication, preoperational, and operational phases of the project. Existing and planned monitoring equipment is similarly described below.

Thermal program acceptance criteria are based on relevant Federal, State, and Local requirements.

Consultation with the NPDES authority, the Maryland Department of the Environment, has been initiated and will continue throughout preapplication, preoperational, and operational phases of the project.}

6.1.1 PREAPPLICATION MONITORING

{Preapplication monitoring for CCNPP Unit 3 consists of past and present thermal monitoring activities conducted for CCNPP Units 1 and 2 (BGE, 1970). CCNPP Unit 1 began commercial operations in May 1975 and Unit 2 in April 1977. More than 30 years of thermal monitoring activities associated with the existing plant establishes the basis for the thermal description and baseline water temperature conditions for CCNPP Unit 3.

Data collected during the studies before CCNPP Units 1 and 2 were constructed were used to design the existing cooling water systems to achieve rapid dispersion of effluents and to minimize water temperature variations in the area of plant influence.

Temperature measurements continue to be taken to monitor CCNPP Units 1 and 2 discharges from the CCNPP site, in accordance with the NPDES permit.

Existing CCNPP site features and the locations of the existing monitoring stations (Outfalls 001, 003, 004 and 005) are shown on Figure 6.1-1 and are further described in Section 6.6. Recent bathymetry characteristics adjacent to the CCNPP site are described in Section 2.3.1.

The CCNPP Units 1 and 2 NPDES permit requires thermal monitoring of wastewater discharges via Outfall 001. Once-through cooling water is discharged via Outfall 001 through tunnels to a discharge point approximately 400 yds (360 m) offshore (MDE, 2002). Outfall 001 is the main discharge monitoring station, representing over 96% of the water discharged by CCNPP Units 1 and 2 (MDE, 2002). Information on other effluents monitored via Outfall 001 is provided in Section 6.6.

Outfall 003 and Outfall 004 are the discharges for the intake screen backwash water. Outfall 005 is a discharge for the onsite swimming pool filter backwash that discharges into an unnamed tributary (i.e., a small swale) that flows into the Chesapeake Bay.

CCNPP Units 1 and 2 were originally licensed for a cooling water design temperature increase of 10°F (5.6°C) at maximum plant operating capacity. The current delta temperature limit of 12°F (6.7°C) is based on a comprehensive assessment of the plant's thermal performance and phytoplankton and zooplankton entrainment studies performed between 1979 and 1980 (ANSP, 1981). The assessment demonstrated compliance with all components of the State of Maryland's thermal mixing zone criteria for discharges to tidal waters. Subsequently, certification of thermal compliance was added to the CCNPP NPDES permit, indicating the State of Maryland's certification as required by the Federal Water Pollution Control Act (USC, 2007).

Inlet and discharge water temperatures at CCNPP Units 1 and 2 are measured using platinum resistance temperature detectors located in the circulating water inlet and waterfront discharge canal respectively. Discharge temperature is continuously monitored and recorded, as described in Section 6.3.

Thermal analysis requirements are specified in the CCNPP Units 1 and 2 Environmental Discharge Surveillance Program. Observed temperatures are calculated as the flow weighted average of individual instantaneous discharge measurements taken once per hour at the concrete surge pit (i.e., end of Discharge Road near northeast corner of plant). The difference in temperature between the intake and discharge is limited by a daily maximum temperature increase of 12°F (6.7°C). This temperature limit is on the daily average of the combined (CCNPP Units 1 and 2) discharge temperature above the inlet temperature. The daily average is the average of the 24 hourly readings each calendar day.

Temperature results are recorded on Discharge Monitoring Report Forms (EPA No. 3320-1) and submitted monthly to the Maryland Department of the Environment, Water Management Administration Compliance Program and to the U.S. Environmental Protection Agency Region III, Office of Compliance and Enforcement NPDES Branch.**}**

6.1.2 PREOPERATIONAL MONITORING

{Preoperational thermal monitoring consists of a continuation of the preapplication monitoring program. Thermal monitoring data collected during the preoperational monitoring program will supplement preapplication monitoring data and further serve to establish baseline bay water temperature conditions for comparative purposes in assessing potential environmental impact from new plant operations. Preoperational monitoring will be conducted during CCNPP Unit 3 site preparation and construction.

Construction related discharges will consist mainly of drainage that collects in sumps at the bottom of excavations which will be pumped to a storm water discharge point. Therefore, no change in thermal discharges is expected during the preoperational monitoring program.

The Maryland Department of the Environment will be notified of pending construction activities and approval of storm water management and erosion/sediment control plans will be obtained in accordance with the NPDES Construction General Permit as described in Section 1.3.

Refer to Section 4.2.1 for anticipated bathymetric characteristics of the Chesapeake Bay area adjacent to the CCNPP site following CCNPP Unit 3 construction activities.**}**

6.1.3 OPERATIONAL MONITORING

{Thermal monitoring will continue during operation of CCNPP Unit 3 to assess water temperature changes associated with effluents from the new plant.

CCNPP Unit 3 will utilize a closed-loop cooling water system. Blowdown from the Circulating Water Supply System (CWS) cooling tower and the Essential Service Water System (ESWS) cooling towers will collect in a retention basin where some of the water's heat will be released to the atmosphere and surrounding media prior to entering the discharge pipes. Additional heat will also be transferred to piping and the surrounding environ during its passage to the discharge outfall. Although the discharge temperature for CCNPP Unit 3 is anticipated to be higher than CCNPP Units 1 and 2, cooling water discharge and flow will be a small percentage of that for the existing units resulting in less energy being transferred to the Chesapeake Bay waters.

Title 26 of the Code of Maryland Regulations 26.08.03.03 (COMAR, 2007) requires temperature data be obtained for new plant effluents to monitor compliance with State of Maryland thermal mixing zone criteria for thermal discharges into tidal waters. These criteria are:

- The 24 hour average of the maximum radial dimension measured from the point of discharge to the boundary of the full capacity 2°C 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 2°C above ambient thermal barrier (measured during the critical periods) may not exceed 50% 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 2°C 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.

Thermal plume modeling performed to estimate the distribution of additional heat load entering the Chesapeake Bay indicates that the combined thermal discharges from CCNPP Units 1, 2, and 3 would meet the State of Maryland thermal mixing zone criteria. Analyses of thermal impacts and the extent of the estimated thermal plume are provided in Section 5.2 and Section 5.3.2.

Although CCNPP Unit 3 will utilize a closed-loop cooling system, it is anticipated that locations of the monitoring stations supporting this unit will be similar to the existing monitoring stations supporting CCNPP Units 1 and 2 (i.e., near the intake screens and discharge structure). Thermal monitoring is likely to only be required at the discharge structure outfall for CCNPP Unit 3. CCNPP Unit 3 structures will occupy the area where the existing onsite swimming pool is located and the monitoring station for pool water discharge will be removed with removal of the associated discharge point.

The extent and duration of the operational monitoring program will conform to requirements of the NPDES permit applicable to CCNPP Unit 3. Water temperatures from CCNPP Unit 3 discharges will meet applicable Federal and State environmental regulatory requirements. As described above, consultation with the Maryland Department of the Environment has been initiated and will continue throughout preapplication, preoperational, and operational phases of the project.}

6.1.4 REFERENCES

{ANSP, 1981. Assessment of Thermal Entrainment and Impingement Impacts on the Chesapeake Bay in the Vicinity of the Calvert Cliffs Nuclear Power Plant, Academy of Natural Sciences of Philadelphia, 1981.

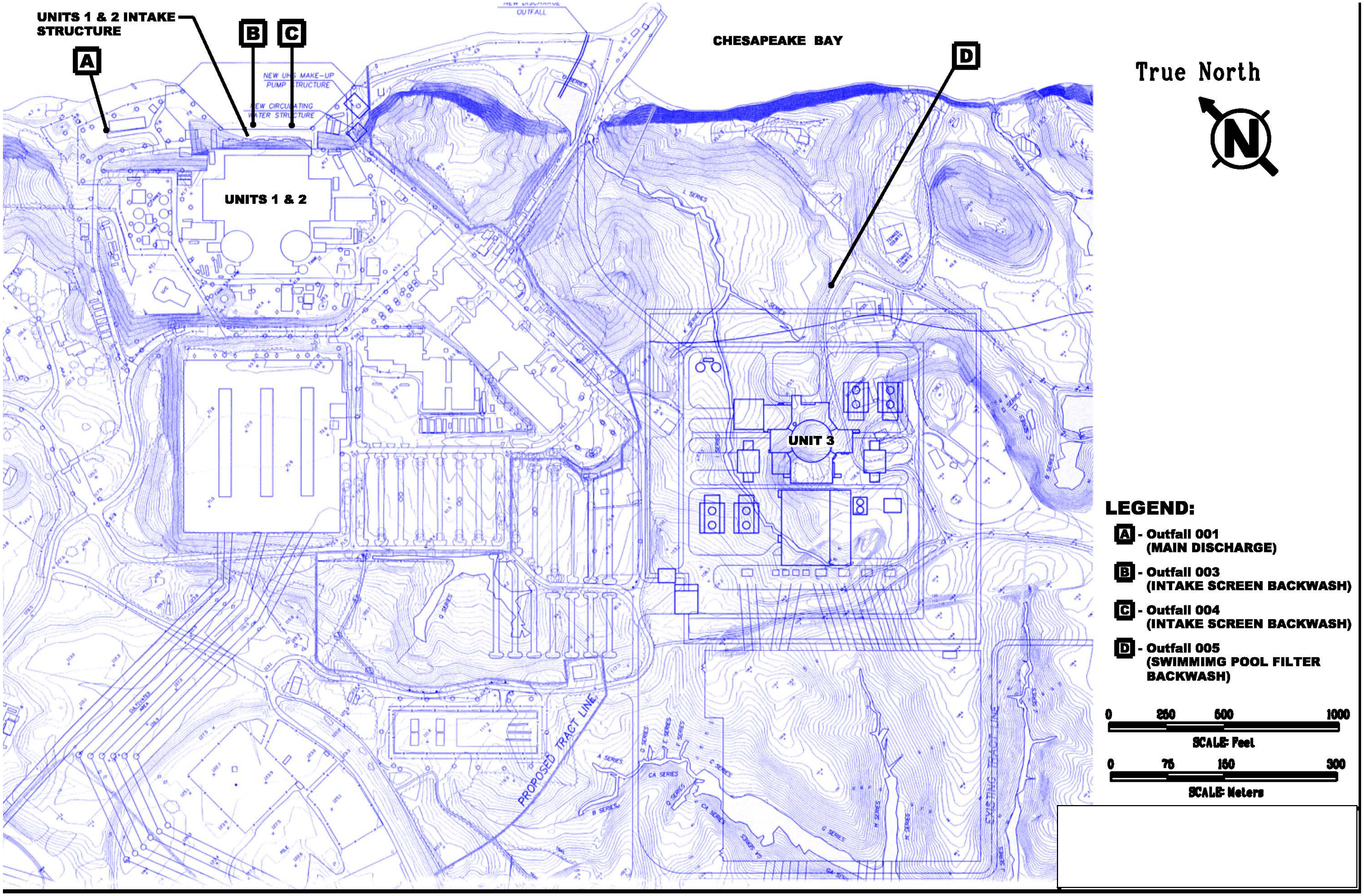
BGE, 1970. Environmental Report Calvert Cliffs Nuclear Power Plant, Baltimore Gas and Electric Company, November 16, 1970.

COMAR, 2007. Code of Maryland Regulations, COMAR 26.08.0.03, Section 03, Water Quality Impact Assessment for Thermal Discharges. 2007.

MDE, 2002. Industrial Discharge Permits Division – Water Management Administration, Summary Report and Fact Sheet for Calvert Cliffs Nuclear Power Plant Inc, Maryland Department of the Environment, March 29, 2002.

USC, 2007. Title 33, United States Code, Part 125, Federal Water Pollution Control Act, 2007.}

Figure 6.1-1—{Existing Thermal Monitoring Stations for CCNPP}



ER Section 6.0

6.2 RADIOLOGICAL MONITORING

{This section describes the objectives, basis, content, reporting and quality assurance aspects of the Calvert Cliffs Nuclear Power Plant (CCNPP) Units 1 and 2 site area Radiological Environmental Monitoring Program (REMP), including monitoring for the Independent Spent Fuel Storage Installation (ISFSI) located onsite, as well as that for Unit 3. The Unit 3 REMP will build upon this existing CCNPP site program where sample types, locations, collection frequencies, and analysis requirements are consistent with satisfying the program requirements (such as objectives, basis, and reporting) that are identified for Unit 3. The Unit 3 REMP is considered a separate program from that administered by CCNPP Units 1 and 2, even though many of the program elements are shared between operating companies on the CCNPP site. The existing REMP for CCNPP Units 1 and 2 covers the entire CCNPP site and environs surrounding the site and will be used to provide baseline information in support of the pre-operational phase of CCNPP Unit 3.

The pre-operational monitoring program for CCNPP Units 1 and 2 was implemented in the summer 1970 (BGE, 1970). CCNPP Unit 1 achieved criticality on October 7, 1974. CCNPP Unit 2 achieved criticality on November 30, 1976. Results of the existing monitoring program for both the pre-operational and operational periods' to date have been reported to the Nuclear Regulatory Commission (NRC) in a series of annual reports. Annual reporting of REMP activities, detected radioactivity, trends, and plant related impacts will continue through the construction and operation of CCNPP Unit 3 and will cover the influence of all three units in a series of reports called the Annual Radiological Environmental Operating Report (AREOR) (CCNPP, 2005b).

The objectives of the REMP for both the existing CCNPP Units 1 and 2 and the addition of Unit 3 are:

a. To verify that radioactivity and ambient radiation levels attributable to plant operations are within the limits specified in 10 CFR Part 50, Appendix I for maintaining doses to members of the public "As Low As Reasonably Achievable (ALARA)" (CFR, 2007b) and within the Environmental Protection Agency Radiation Protection Standards as stated in 40 CFR Part 190 (CFR, 2007a);

b. To detect any measurable buildup of long-lived radionuclides in the environment;

c. To monitor and evaluate ambient radiation levels; and

d. To determine whether any statistically significant increase occurs in concentration of radionuclides in important pathways. (CCNPP, 2005b)

The CCNPP Units 1 and 2 monitoring program was originally developed based on the guidance from Regulatory Guide 4.1 (NRC, 1975). The current environmental monitoring sampling program for the site is consistent with the guidance provided in standard radiological effluent technical specifications (CFR, 2007a) as described in NUREG-1301 (NRC, 1991) and NRC guidance (NRC, 1979b).

Expected changes to the existing Units 1 and 2 REMP to reflect the addition of CCNPP Unit 3 to the CCNPP site and changing monitoring requirements are noted in Section 6.2.7.}

6.2.1 PATHWAYS MONITORED

{Environmental exposure pathways to man resulting from CCNPP Unit 3 radiological effluents are described in Section 5.4.1. These are the same environmental pathways that apply to effluents from Units 1 and 2. Radioactive liquid pathways include internal exposure due to ingestion of aquatic foods (fish and invertebrates) and external exposure due to recreational activities on the shoreline and in the water (swimming and boating). Radioactive gaseous pathways include external exposure due to immersion in airborne effluents and exposure to a deposited material on the ground plane. Internal exposures are due to ingestion of food products grown in areas under the influence of atmospheric releases, and inhalation from airborne effluents. In additional, direct radiation exposure from the facility structures is also considered a potential pathway. The REMP for both Units 1 and 2 and Unit 3 are designed to evaluate detectable levels of radioactive materials in environmental media associated with these exposure pathways.

The relationships between exposure pathways and environmental media included in the CCNPP Units 1 and 2 REMP sampling program are shown in Table 6.2-1and are applicable to CCNPP Unit 3.

The exposure pathways being monitored are listed in Tables 6.2-2 and 6.2-3 for the existing REMP. These same pathways and monitoring locations will be applied to the CCNPP Unit 3 REMP, except as noted in Section 6.2.7.}

6.2.2 LAND USE CENSUS

{A land use census for the CCNPP site area is conducted during the growing season at least once every 12 months as described in the Offsite Dose Calculation Manual (ODCM) (CCNPP, 2005a). The same land use census requirement will be applied to Unit 3.} The census identifies the following within each of the sixteen meteorological sectors in the 5 mi (8 km) vicinity:

- The nearest milk animal,
- The nearest residence, and
- The nearest garden of greater than 500 ft^2 (50 m^2) producing broad leaf vegetation.

The purpose of the land use census is to identify needed changes in the Radiological Environmental Monitoring Program. This ensures that sampling locations associated with media that have the highest dose potential are included in the REMP as changes in land use patterns occur over time. The implementation of the land use census satisfies the requirement of 10 CFR Part 50, Appendix I (CFR, 2007b).

6.2.3 ENVIRONMENTAL MONITORING PROGRAM SAMPLE TYPES

6.2.3.1 DIRECT RADIATION MONITORING

{Thermoluminescent dosimeters (TLDs) are used to measure ambient gamma radiation levels at many locations surrounding the existing units and the ISFSI. Current locations are shown in Tables 6.2-2 through 6.2-5, and Figures 6.2-1 through 6.2-4. Data collected as part of the existing Units 1 and 2 TLD program will be included as part of the CCNPP Unit 3 REMP.}

TLDs are crystalline devices that store energy when they are exposed to radiation. They are processed after their exposure periods, with minimal loss of information, to read the amount of stored energy, or radiation, that they had accumulated during their exposure period in the field. This makes them well suited for quarterly environmental radiation measurements.

During TLD processing, stored energy is released as light, and is measured by a TLD reader. The light intensity is proportional to the radiation dose to which the TLD was exposed.

6.2.3.2 AIRBORNE ACTIVITY MONITORING

{Radioiodine and particulate samples are currently collected with continuously operating air pumps, particulate filters, and iodine collection cartridges at sample points A1 through A5, as shown in Table 6.2-2, Table 6.2-3, Figure 6.2-1 and Figure 6.2-2. Sampling frequencies are shown in Table 6.2-2. Filter elements and iodine cartridges are typically changed out on a weekly basis. Airborne activity monitoring data collected as part of the CCNPP Units 1 and 2 REMP will be included as part of the CCNPP Unit 3 monitoring program. Additions to the airborne monitoring program that are related directly to the Unit 3 REMP are identified in Section 6.2.7.}

6.2.3.3 WATERBORNE MONITORING

{Waterborne and sediment samples are currently collected at locations Wa1, Wa2, and Wb1 as shown in Table 6.2-2, Table 6.2-3, Figure 6.2-1 and Figure 6.2-2. Sampling frequencies are shown in Table 6.2-2. Waterborne activity monitoring data collected as part of the Units 1 and 2 REMP will be included as part of the Unit 3 monitoring program. Additions to the waterborne monitoring program that are related directly to the CCNPP Unit 3 REMP are identified in Section 6.2.7.}

6.2.3.4 INGESTION PATHWAY MONITORING

{For liquid effluent pathways, fish and invertebrates are currently collected at locations Ia1 through Ia6 as shown in Table 6.2-2, Table 6.2-3, Figure 6.2-1, and Figure 6.2-2. Food products (vegetation) are currently sampled at locations Ib1 through Ib9 as also shown in Table 6.2-2, Table 6.2-3, Figure 6.2-1, and Figure 6.2-2. Environmental ingestion pathway media collected as part of the CCNPP Units 1 and 2 REMP as shown on Tables 6.2-2 and 6.2-3 will be included as part of the Unit 3 monitoring program. Milk sampling is not currently part of the REMP for CCNPP Units 1 and 2 due to a lack of milk animals in the surrounding environment and will not be part of the CCNPP Unit 3 REMP unless the annual land use census identifies milk as significant exposure pathway in the site area.}

6.2.4 SAMPLE SIZES

Table 6.2-7 is an estimate of typical sample sizes for radiological analyses. These are approximations and may vary depending on such things as laboratory procedures and methods, available media obtained during sampling, lower limits of detection (LLDs), and split sampling, if applicable.

6.2.5 RADIOLOGICAL ENVIRONMENTAL MONITORING PROGRAM REPORTS

Routine REMP reports are submitted annually to the NRC. The annual REMP reports for {both CCNPP Units 1 and 2 and CCNPP Unit 3} include summaries, interpretations, and an analysis of trends of the results of the radiological environmental surveillance activities for the report period. The reports also include comparisons with preoperational studies and with operational controls, as appropriate, and with previous environmental surveillance reports, and an assessment of any observed impacts of the plant operation on the environment. The reports also include the results of the land use census for {CCNPP Units 1 and 2, and CCNPP Unit 3. Either a single joint report covering all three units on the CCNPP site, or two separate reports, one for CCNPP Units 1 and 2 and one for CCNPP Unit 3, will be submitted annually and include all data collected and shared between operating companies.}

6.2.6 QUALITY ASSURANCE PROGRAM

The REMP quality assurance program for **{**CCNPP Unit 3**}** will be conducted in accordance with Regulatory Guide 4.15, Revision 2 (NRC, 2007).

{The REMP quality assurance program at CCNPP Units 1 and 2 prior to CCNPP Unit 3 has been conducted in accordance with Regulatory Guide 4.15, Revision 1 (NRC, 1979a). For site area environmental sample results that are to be shared between all three units, the most limiting quality assurance requirements of either revision of Regulatory Guide 4.15 will be applied, or independent sampling and analyses for Units 1 and 2 and Unit 3 will be performed in accordance with their respective versions of the Regulatory Guide 4.15 guidance document.

The quality assurance program also involves the use of "Interlaboratory Comparison Program" samples as discussed in the ODCM and split samples for all parameters listed in Table 6.2-6 (NRC, 1977). The comparisons are reported in annual REMP reports (CCNPP, 2005a). Since no NRC approved laboratory supplies TLDs as part of a comparison program, no TLDs are analyzed as part of the "Interlaboratory Comparison Program." The nature of TLDs precludes their use in the split sample program.**}**

6.2.7 REMP MODIFICATIONS FOR {CCNPP UNIT 3}

{CCNPP Unit 3 is located approximately 0.5 miles (0.8 km) south-southeast (SSE) of the center line between CCNPP Units 1 and 2. This places the CCNPP Unit 3 construction footprint in the site area where an existing REMP air particulate and radioiodine sampler (Station A1) and TLD location (DR7) are currently situated. This will require the relocation of the monitoring equipment to an area outside of that portion of the site area that is involved with CCNPP Unit 3 construction. Prior to initiation of construction activities for CCNPP Unit 3, replacement sampling equipment will be located in the southern sector from CCNPP Units 1 and 2 near the site boundary (as power availability and road access permit). Three vegetation species sample locations (Ib4, Ib5 and Ib6) also are impacted by the CCNPP Unit 3 construction footprint and will be relocated to be near the new site of the Station A1 air particulate and radioiodine collection equipment.

One additional air particulate and iodine sampler (including TLD) location will be added to the CCNPP Unit 3 REMP at least two years prior to startup to cover the south-southwest (SSW) site boundary area as viewed from CCNPP Unit 3 location. This sampler addition will provide coverage to satisfy REMP siting criteria which stipulates that there are at least three samplers close to CCNPP site boundary locations of highest calculated annual average ground-level deposition rates (D/Q's). The ODCM provides estimates (CCNPP, 2005a) of the annual D/Q for all sectors which indicate that for sectors not bordered by water, the southeast (SE), south (S), and south-southwest (SSW) sectors rank the highest potentially impacted sectors at 1 mi (1.6 km) (approximates the site boundary in those sectors) relative to CCNPP Unit 3 operations. Sample collections from this airborne monitoring location will include the same sample collection frequency, type of analysis and detection limits as applied to all other airborne samples as detailed in Tables 6.2-2 and 6.2-6.

An additional surface water sampling site near the CCNPP Unit 3 discharge location in the Chesapeake Bay will be added to the Unit 3 REMP since the CCNPP Unit 3 discharge point is several thousand feet south of the existing sampling location for the discharge from CCNPP Units 1 and 2. Sample collections from this surface station will be initiated at least two years prior to Unit 3 startup, and will include the sample collection frequency, type of analysis and detection limits as applied to all other surface water samples as detailed in Tables 6.2-2 and 6.2-6.

With respect to groundwater monitoring, the existing CCNPP site REMP for CCNPP Units 1 and 2 and NRC regulations contain no explicit requirements to routinely monitor groundwater onsite near plant facilities. By design, liquid effluents are not released to groundwater or structures that discharge to groundwater, and as such, there is no expected or intended human exposure pathway associated with groundwater for CCNPP Unit 3. However, recent nuclear industry initiatives by the Nuclear Energy Institute, the Electric Power Research Institute and NRC assessments (NRC, 2006) of existing nuclear reactors, indicates that guidance documents covering the implementation of NRC regulation 10 CFR 20.1406 (CFR, 2007c) relating to groundwater monitoring for both operating and future nuclear reactors is being developed. Groundwater monitoring near plant facilities will provide an early indication if unexpected releases through system leaks or failures has occurred and is impacting the environment beyond expected pathways. Development of these guidance documents concerning ground water protection are being followed and future requirements will be addressed, as applicable, for inclusion in the CCNPP Unit 3 REMP.}

6.2.8 REFERENCES

{BGE, 1970. Environmental Report, Calvert Cliffs Nuclear Power Plant, Baltimore Gas and Electric, November 17, 1970.

CFR, 2007a. Title 40, Code of Federal Regulations, Part 190, Environmental Protection Standards for Nuclear Power Operations, U.S. Environmental Protection Agency, 2007.

CFR, 2007b. Title 10, Code of Federal Regulations, Part 50, Appendix I, Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low as is Reasonably Possible' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents, January 2007.

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NRC, 1979b. Branch Technical Position, Revision 1, Radiological Assessment Branch Technical Position regarding Radiological Environmental Monitoring Programs, Nuclear Regulatory Commission, November 27, 1979.

NRC, 1991. Offsite Dose Calculation Manual Guidance: Standard Radiological Effluent Controls for Pressurized Water Reactors, NUREG-1301, Nuclear Regulatory Commission, 1991.

NRC, 2006. Liquid Radioactive Release Lessons Learned Task Force, Final Report, Nuclear Regulatory Commission, September 1, 2006.

NRC, 2007. Quality Assurance for Radiological Monitoring Programs (Inception Through Normal Operations to License Termination) – Effluent Streams and the Environment Regulatory Guide 4.15, Interim Revision 2, Nuclear Regulatory Commission, March 2007.}

Table 6.2-1—{Effluent Exposure Pathways and Environmental Sampling Media }

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Effluent Exposure Pathways	REMP Sampling Media
Liquid Effluents: (1)	
Ingestion fish	Commercially and recreational fish species
Ingestion invertebrates	Commercially and recreational invertebrates
Shoreline exposure (external direct)	Sediments from shoreline
Swimming & boating (external direct)	Surface waters
Gaseous Effluents: (2)	
Cloud immersion (external direct)	TLDs
Ground plane (external direct)	TLDs
Inhalation	Air particulate sampling, Iodine sampling
Ingestion of agricultural products	Broadleaf vegetation

Notes:

1. No drinking water or irrigation pathway due to brackish water of the Chesapeake Bay.
2. No milk ingestion pathway included. No milk animals located within 5 mi (8 km) of the site. (Meat ingestion not a significant pathway contributor.)

Table 6.2-2—{Existing Radiological Environmental Monitoring Program for CCNPP}

(Page 1 of 2)

Exposure Pathway And/Or Sample	Number of Representative Samples and Sample Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
Direct Radiation	23 routine monitoring stations (DR1-DR23) (Table 6.2-3) either with two or more dosimeters or with one instrument for measuring and recording dose rate continuously, placed as follows: An inner ring of stations, one in each meteorological sector in the general area of the Site Boundary (DR1-DR9). An outer ring of stations, one in each meteorological sector in the 4 to 5 mi (6 to 8) km range from the site (DR10-DR18). The remaining stations (DR19-DR23) to be placed in special interest areas such as population centers, nearby residences, schools, and in one area to serve as a control station.	At Least Quarterly	Gamma Dose at Least Quarterly
Airborne Radioiodine and Particulates	Samples from 5 locations (A1-A5) (Table 6.2-3): 3 samples (A1-A3) from close to the 3 Site Boundary locations, in different sectors of the highest calculated annual average ground-level D/Q. 1 sample (A4) from the vicinity of a community having the highest calculated annual average ground-level D/Q. 1 sample (A5) from a control location, as for example 9 to 19 mi (15 to 30 km) distance and in the least prevalent wind direction.	Continuous sampler operation with sample collection weekly – or more frequently if required by dust loading.	Radioiodine Canister: I-131 analysis weekly Particulate Sampler: Gross beta radioactivity analysis following filter change. Gamma isotopic analysis of composite (by location) quarterly.
Waterborne a. Surface	(Table 6.2-3) 1 sample at intake area (Wa1) 1 sample at discharge area (Wa2)	Composite Sample [Note: (a)] over 1 month period	Gamma Isotopic Analysis [Note: (b)] monthly. Composite for tritium analysis quarterly
b. Sediment from shoreline	1 sample from downstream area with existing or potential recreational value (Wb1)	Semiannually	Gamma Isotopic Analysis semiannually

Table 6.2-2—{Existing Radiological Environmental Monitoring Program for CCNPP}
(Page 2 of 2)

Exposure Pathway And/Or Sample	Number of Representative Samples and Sample Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
Ingestion a. Fish and Invertebrates	(Table 6.2-3) 3 samples of commercially, and/or recreationally important species (2 fish species and 1 invertebrate species) in vicinity of plant discharge area (Ia1-Ia3). 3 samples of same species in areas not influenced by plant discharge (Ia4-Ia6).	Sample in season, or semiannually if they are not seasonal.	Gamma Isotopic Analysis on edible portions.
b. Food Products	Samples of 3 different kinds of broad leaf vegetation grown near the Site Boundary at 2 different locations of highest predicted annual average ground level D/Q (Ib1-Ib6) [Note: (c)]. 1 sample of each of the similar-broad leaf vegetation grown 9 to 19 mi (15 to 30 km) distant in the least prevalent wind direction (Ib7-Ib9).	Monthly during growing season.	Gamma isotopic and 1-131 analysis.

Notes:

a. A Composite Sample is a combination of individual samples obtained at intervals that are short (e.g., hourly) in relation to the compositing time interval (e.g., monthly) to assure obtaining a representative sample.

b. A Gamma Isotopic Analysis is an analytical method of measurement used for the identification and quantification of gamma emitting radionuclides.

c. Broad leaf vegetation sampling of at least three different kinds of vegetation may be performed at the site boundary in each of two different direction sectors with the highest predicted D/Qs in lieu of the garden census.

Table 6.2-3—{Existing Environmental Monitoring Sites for CCNPP }

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Sample Site/Type	Sector	Distance km	Distance mi	Description
DR1	NW	0.6	0.4	Onsite, Along Cliffs
DR2	WNW	2.7	1.7	Rt. 765, Auto Dump
DR3	W	2.3	1.4	Rt. 765, Giovanni's Tavern (Knotty Pine)
DR4	WSW	2.0	1.2	Rt. 765, Across from White Sand Drive
DR5	SW	2.4	1.5	Rt. 765 at Johns Creek
DR6, A4	SSW	2.9	1.8	Rt. 765 at Lusby, Frank's Garage
DR7, A1, Ib4, Ib5, Ib6	S	0.7	0.5	Onsite, before entrance to Camp Conoy
DR8, A2	SSE	2.5	1.5	Camp Conoy Road at Emergency Siren
DR9, A3	SE	2.6	1.6	Bay Breeze Road
DR10	NW	6.4	4.0	Calvert Beach Rd and Decatur St.
DR11	WNW	6.6	4.1	Dirt Road off Mackall Rd and Parran Rd
DR12	W	6.7	4.2	Bowen Rd and Mackall Rd
DR13	WSW	6.1	3.8	Mackall Rd near Wallville
DR14	SW	6.4	4.0	Rodney Point
DR15	SSW	6.2	3.9	Mill Bridge Rd and Turner Rd
DR16	S	6.5	4.1	Across from Appeal School
DR17	SSE	5.9	3.7	Cove Point Rd and Little Cove Point Rd
DR18	SE	7.1	4.5	Cove Point
DR19	NW	4.4	2.8	Long Beach
DR20	NNW	0.4	0.3	Onsite, near shore
DR21, A5, Ib7, Ib8, Ib9	WNW	19.3	12.1	Emergency Operations Facility
DR22	S	12.5	7.8	Solomons Island
DR23	ENE	12.6	7.9	Taylors Island, Carpenter's Property
Wa1	NNE	0.2	0.1	Intake Area
Wa2, Ia1, Ia2	N	0.3	0.2	Discharge Area
Wb1	ESE	0.6	0.4	Shoreline at Barge Road
Ib1, Ib2, Ib3,	SSE	2.6	1.6	Garden Plot off Bay Breeze Rd
Ia4, Ia5	(Area not influenced by Plant Discharge)			Patuxent River
Ia3	E	0.9	0.6	Camp Conoy
Ia6	NNW	10.7	6.7	Kenwood Beach
Ia10	SSE	15.3	9.5	Hog Island

Note: Distance and direction are from the central point between the CCNPP Units 1 and 2 containment buildings.

Key: (where # is the sequential number of the sampling station)

- DR# Direct Radiation, TLD Station
- A# Airborne Sampling Station
- Wa# Waterborne Sampling Station at Intake (Wa1) and Discharge (Wa2)
- Wb1 Waterborne Sediment Sampling Station
- Ia# Fish and Invertebrates Sampling Station
- Ib# Broad Leaf Sampling Station

Table 6.2-4—{Radiological Environmental Monitoring Program for the Independent Spent Fuel Storage Installation }

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Exposure Pathway And/Or Sample	Number of Representative Samples and Sample Locations	Sampling and Collection Frequency	Type and Frequency of Analysis
Direct Radiation	Direct radiation dosimetry shall be collected from locations SFDR1-SFDR16, DR7, and DR30	At Least Quarterly	Gamma Dose at Least Quarterly
Airborne Radioiodine and Particulate Activity	Air particulate samples shall be collected from locations A1 and SFA1-SFA4	Continuous sampler operation with sample collection weekly - or more frequently if required by dust loading	Radioiodine Canister: I-131 analysis weekly Particulate Sampler: Gross beta radioactivity analysis weekly, following filter change. Gamma isotopic analysis of composite (by location) quarterly
Vegetation	Vegetation samples shall be collected at locations SFb1-SFb5	Sampled monthly during the growing season	Gamma Isotopic Analysis monthly
Soil	Soil samples shall be collected at locations SFS1-SFS5	At Least Quarterly	Gamma Isotopic Analysis quarterly

Table 6.2-5—{Radiological Environmental Monitoring Program for the Independent Spent Fuel Storage Installation }

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Station	Description	Distance (km) [Note: (a)]	Direction (sector) [Note: (a)]
Air Samplers			
A1	Onsite before Entrance to Camp Conoy	0.3	ESE
SFA1	Meteorological Station	0.3	NW
SFA2	CCNPP Visitor's Center	0.8	N
SFA3	NNW of ISFSI	0.1	NNW
SFA4	SSE of ISFSI	0.1	SSE
TLD Locations			
SFDR1	SW of ISFSI	0.2	SW
SFDR2	N of ISFSI	0.2	N
SFDR3	N of ISFSI	0.1	N
SFDR4	NE of ISFSI	<0.1	NE
SFDR5	E of ISFSI	<0.1	E
SFDR6	ESE of ISFSI	0.1	ESE
SFDR7	CCNPP Visitor's Center	0.8	N
SFDR8	NNW of ISFSI	0.1	NNW
SFDR9	SSE of ISFSI	0.1	SSE
SFDR10	NW of ISFSI	0.1	NW
SFDR11	WNW of ISFSI	0.1	WNW
SFDR12	WSW of ISFSI	<0.1	WSW
SFDR13	S of ISFSI	<0.1	S
SFDR14	SE of ISFSI	0.1	SE
SFDR15	ENE of ISFSI	<0.1	ENE
SFDR16	SW of ISFSI	<0.1	SW
DR7 [Note: (b)]	On Site Before Entrance to Camp Conoy	0.3	ESE
DR30	Meteorological Station	0.3	NW
SFDR17	NNE of ISFSI	0.1	NNE
SFDR18	W of ISFSI	0.04	W
Vegetation			
SFb1	Meteorological Station	0.3	NW
SFb2	CCNPP Visitor's Center	0.8	N
SFb3	NNW of ISFSI	0.1	NNW
SFb4	SSE of ISFSI	0.1	SSE
SFb5	On Site Before Entrance to Camp Conoy	0.3	ESE
Soil			
SFS1	Meteorological Station	0.3	NW
SFS2	CCNPP Visitor's Center	0.8	N
SFS3	NNW of ISFSI	0.1	NNW
SFS4	SSE of ISFSI	0.1	SSE
SFS5	Onsite Before Entrance to Camp Conoy	0.3	ESE

Notes:

a. Distance and direction are from the Central Point of the ISFSI.
b. DR7 is common to both the REMP and the ISFSI Monitoring Program.

Table 6.2-6—{Lower Limits of Detection (LLD) for Environmental Media }

(Page 1 of 1)

Direct Radiation	Parameter	Units	Frequency	LLD
Direct Radiation:	Gamma Dose	mR	At Least Quarterly	[Note: (a)]
Airborne Activity:				
a. Radioiodine Canister	I-131	pCi/m^3	At Least Weekly	0.07
b. Particulate Filter	Gross Beta Activity	pCi/m^3	At least Weekly	0.01
	Cs-134	pCi/m^3	At Lease Quarterly	0.05
	Cs-137	pCi/m^3	At Lease Quarterly	0.06
Waterborne Activity:				
a. Surface Water Sample	H-3	pCi/l	At Lease Quarterly	2000
	Mn-54	pCi/l	At Least Monthly	15
	Fe-59	pCi/l	At Least Monthly	30
	Co-58	pCi/l	At Least Monthly	15
	Co-60	pCi/l	At Least Monthly	15
	Zn-65	pCi/l	At Least Monthly	30
	Zr-95/Nb-95	pCi/l	At Least Monthly	15
	I-131	pCi/l	At Least Monthly	1
	Cs-134	pCi/l	At Least Monthly	15
	Cs-137	pCi/l	At Least Monthly	18
	Ba-140/La-140	pCi/l	At Least Monthly	15
b. Shoreline Sediment Sample	Cs-134	pCi/kg, dry	At Least Semiannually	150
	Cs-137	pCi/kg, dry	At Least Semiannually	180
Ingestible Activity:				
a. Fish and Invertebrates	Mn-54	pCi/kg, wet	Note: (b)	130
	Fe-59	pCi/kg, wet	Note: (b)	260
	Co-58	pCi/kg, wet	Note: (b)	130
	Co-60	pCi/kg, wet	Note: (b)	130
	Zn-65	pCi/kg, wet	Note: (b)	260
	Cs-134	pCi/kg, wet	Note: (b)	130
	Cs-137	pCi/kg, wet	Note: (b)	150
b. Milk	I-131	pCi/l, wet	At Least Monthly, Note: (c)	1
	Cs-134	pCi/l, wet	At Least Monthly, Note: (c)	15
	Cs-137	pCi/l, wet	At Least Monthly, Note: (c)	18
	Ba-140/La-140	pCi/l, wet	At Least Monthly, Note: (c)	15
c. Food Products	I-131	pCi/kg, wet	At Least Monthly, Note: (d)	60
	Cs-134	pCi/kg, wet	At Least Monthly, Note: (d)	60
	Cs-137	pCi/kg, wet	At Least Monthly, Note: (d)	80

Notes:

a. LLD for TLDs used for environmental measurements shall be in accordance with the recommendations of Regulatory Guide 4.13.

b. The fish and invertebrates shall be sampled at least once per year in season, or semiannually if they are not seasonal.

c. The milk samples need be collected and analyzed only if the milk is commercially available in quantities greater than 130 liters (34.3 gal) per year.

d. The food products shall be sampled during the growing season.

Table 6.2-7—{Typical Sample Sizes for Environmental Media }

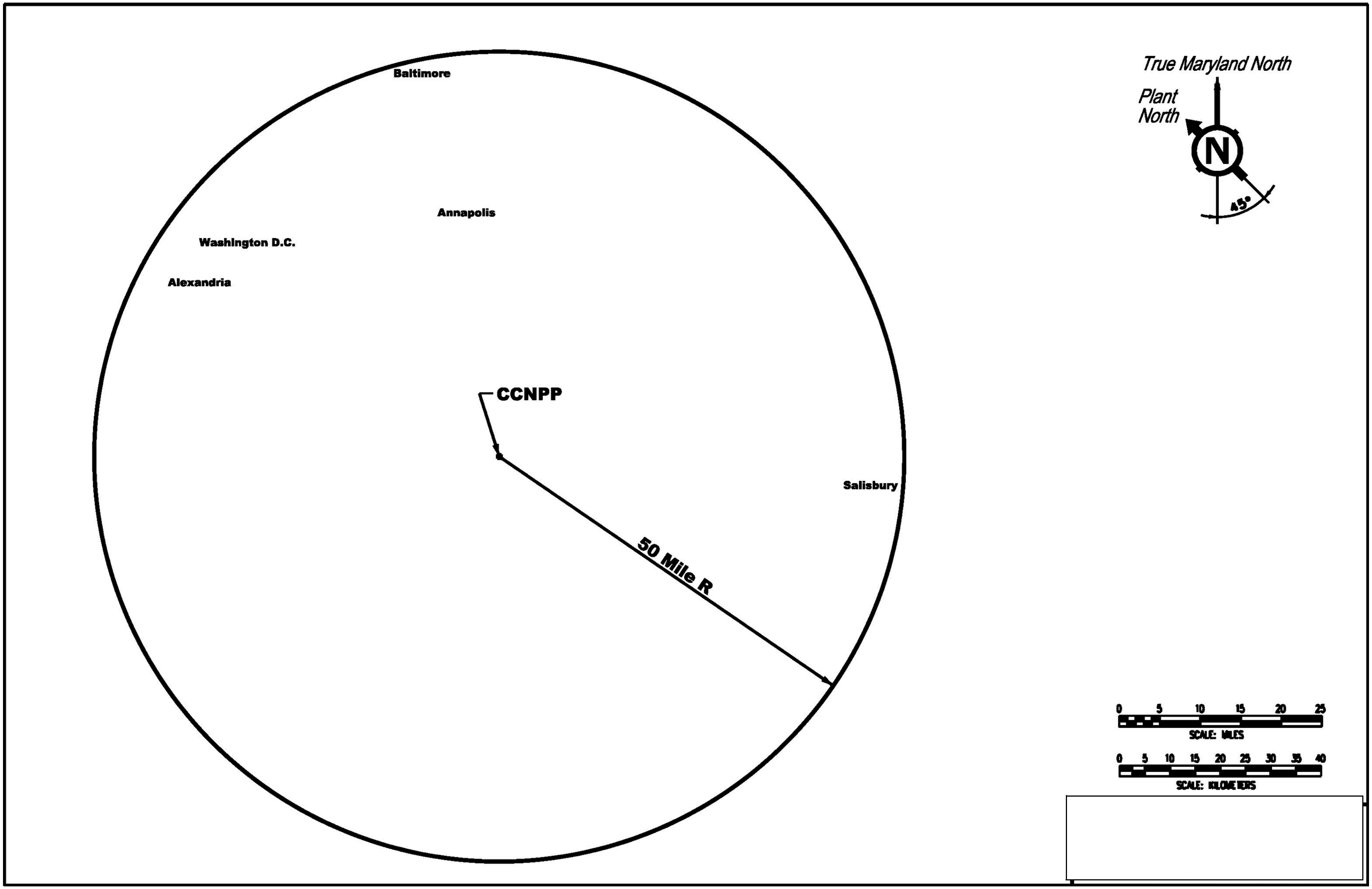
Page 1 of 1

Media	Approximate Weight/Volume
Air Particulate	100 m^3 (3,531 ft^3)
Algae	2 kg (4.4 lb)
Aquatic (Special)	2 kg (4.4 lb)
Aquatic Vegetation	2 kg (4.4 lb)
Benthic Organisms	2 kg (4.4 lb)
Biological Organisms	2 kg (4.4 lb)
Cattle Feed	1 - 2 kg (2.2 – 4.4 lb)
Charcoal Filter	100 m^3 (3,531 ft^3)
Crab	2 kg (4.4 lb)
Estuary Water	1 gallon (3.8 liters) [Note: (a)]
Fish	2 kg (4.4 lb)
Food Crop	0.5 – 1 kg (1.1 – 2.2 lb)
Fresh Water	1 quart (0.95 liters) [Note: (a)]
Green Leafy Vegetation	0.5 – 1 kg (1.1 – 2.2 lb)
Ground Water	1 gallon (3.8 liters) [Note: (a)]
Hard-Shell Clam	2 kg (4.4 lb)
Hard-Shell Clam, Shell	2 kg (4.4 lb)
Mixed Vegetation	0.5 – 1 kg (1.1 – 2.2 lb)
Mussel Body	2 kg (4.4 lb)
Mussel Shell	2 kg (4.4 lb)
Sediment	Cores as Required [Note: (b)]
Soft-Shell Clam (Mya arenaria)	2 kg (4.4 lb)
Soft-Shell Clam, Shell	2 kg (4.4 lb)
Soil	1 – 2 kg (2.2 – 4.4 lb)

Notes:

a. One gallon (3.8 liters) is needed for gamma spectrometry/tritium analysis ONLY. An additional gallon (3.8 liters) is required for a gross beta analysis.
b. Six core sections having a minimum depth of 6 in (15.2 cm) by means of a 2 in (5.1 cm) ID coring device.
c. The sample sizes in this table should only be used as representative of approximate sizes needed. These may vary significantly depending on the LLD of the isotopes being measured.

Figure 6.2-1—{CCNPP Sampling Locations 0-2 mi (0-3.2 km)}



ER Section 6.0

Figure 6.2-2—{CCNPP Sampling Locations 0-10 mi (0-16 km)}

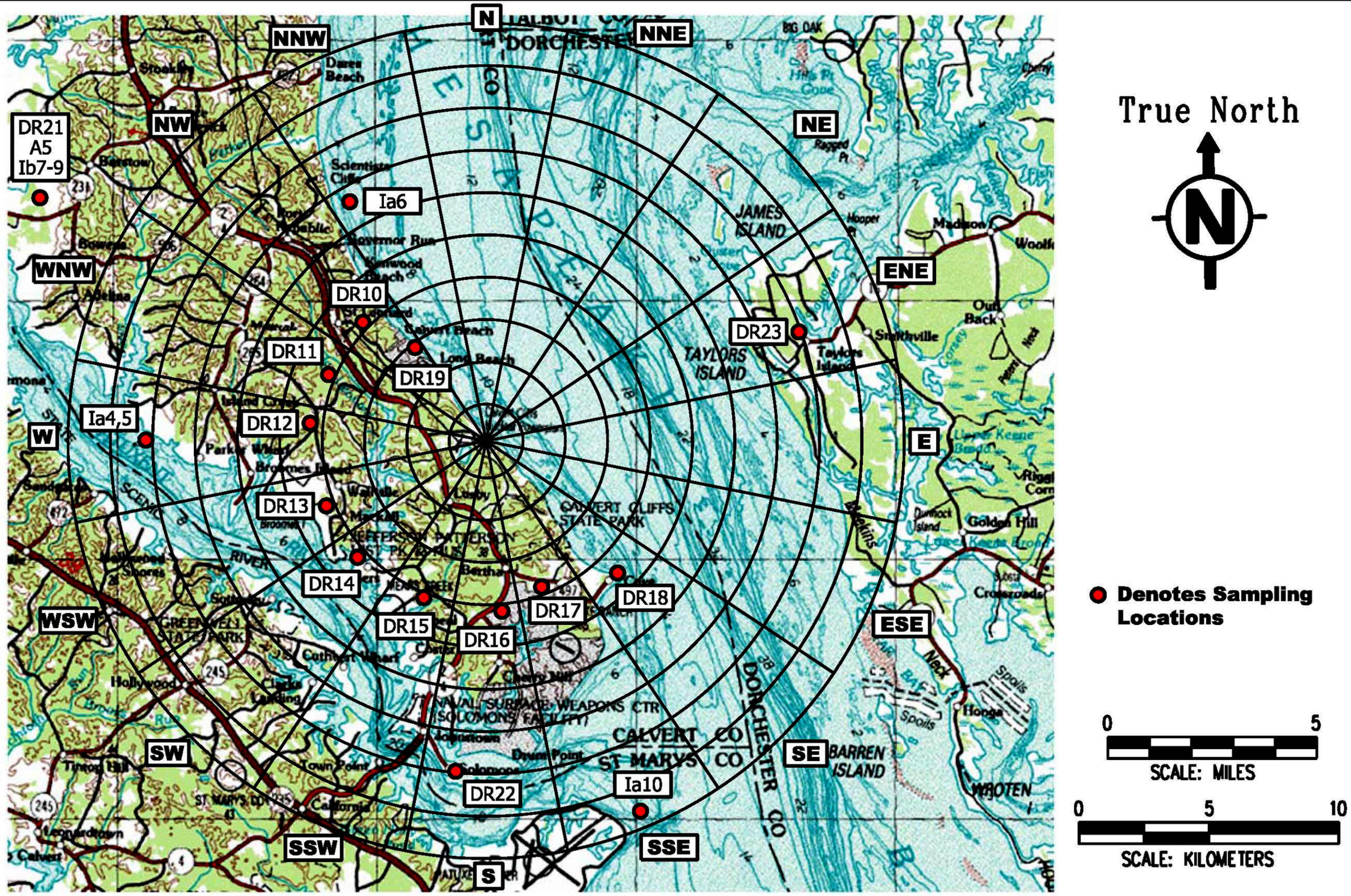


Figure 6.2-3—{CCNPP Independent Spent Fuel Storage Installation Sampling Locations}

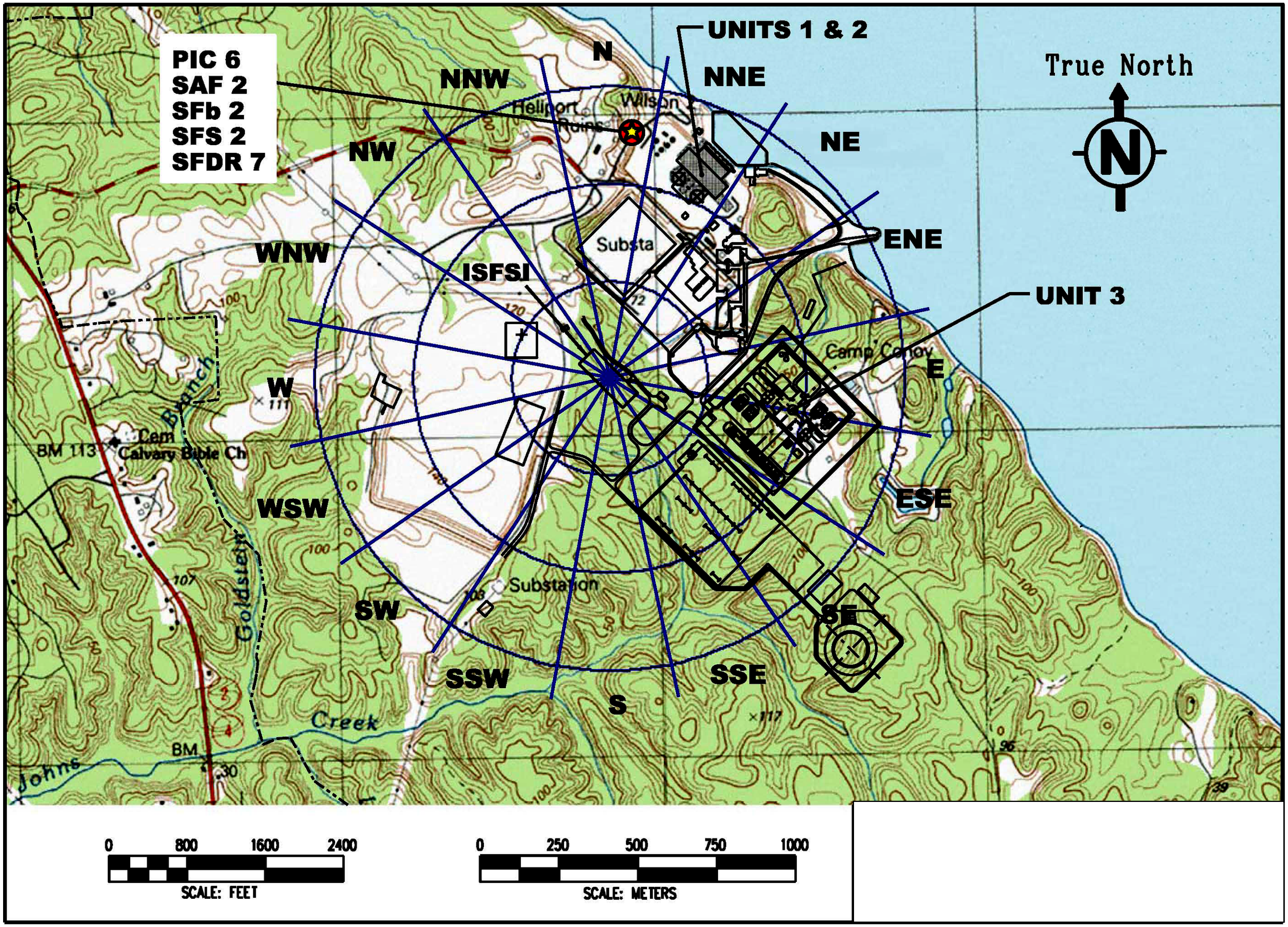


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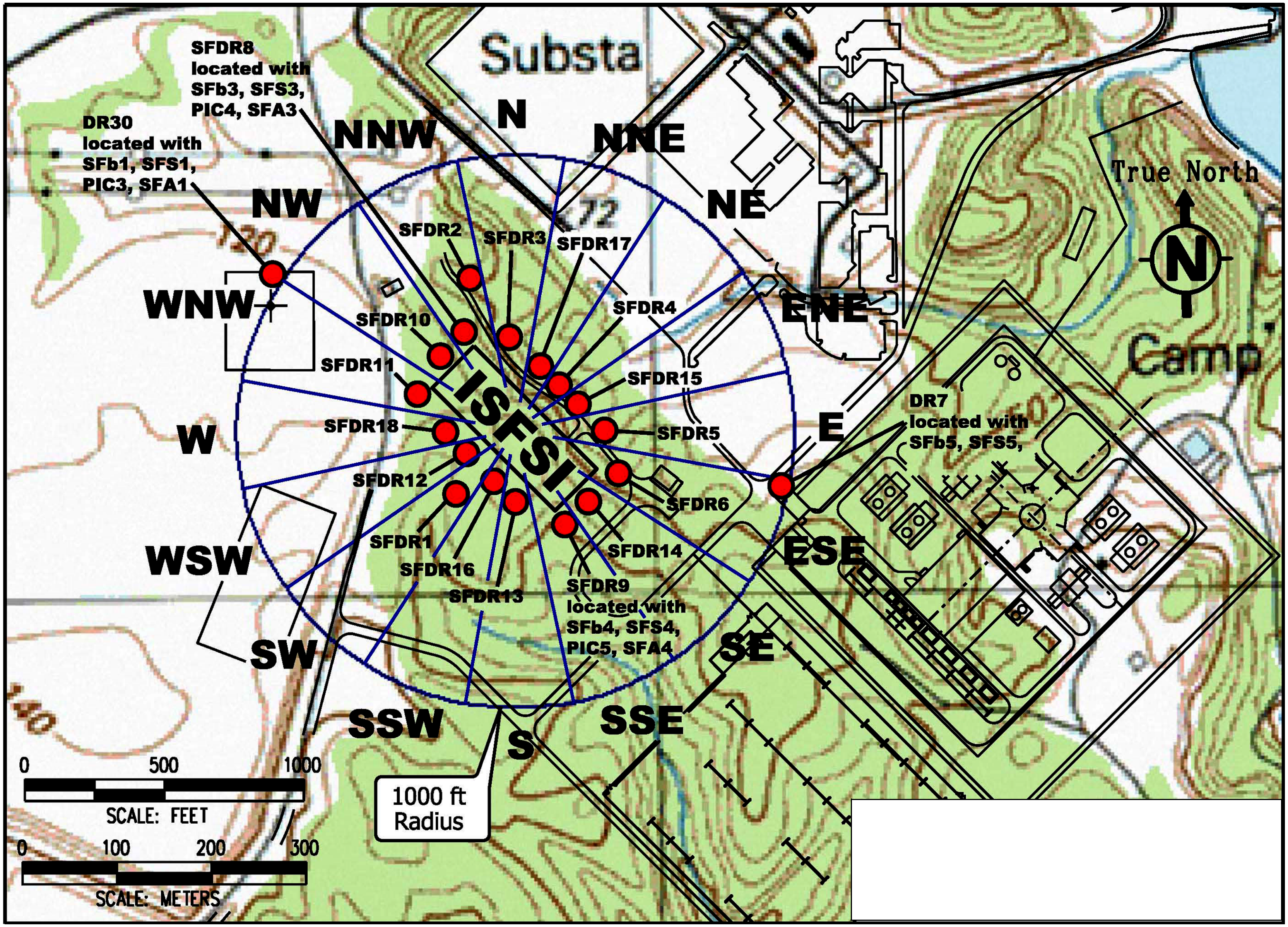
Figure 6.2-4—{Enlarged Map of CCNPP Independent Spent Fuel Storage Installation Sampling Locations}



6.3 HYDROLOGICAL MONITORING

This section describes the hydrological monitoring program that will be implemented to monitor the effects of the {Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3}. Elements of the hydrological program relating to thermal, radiological, and chemical monitoring are described separately in Section 6.1, Section 6.2, and Section 6.6, respectively.

This section includes the pre-application monitoring program that discusses the {existing hydrological monitoring program at CCNPP Units 1 and 2 as well as the Unit 3 site and the} programs to monitor {CCNPP Unit 3} during the construction/pre-operational and operational phases.

Section 2.3.1 describes the vicinity watershed and stream flow data collected by the U.S. Geological Survey and the {Maryland Geological Survey}. Groundwater velocities, flow rates and sediment transport characteristics and shore erosion are discussed in Section 2.3.1. Section 2.3.2 describes surface and groundwater uses. Features of the {CCNPP} site, including boundaries and bathymetry of all surface water bodies adjacent to the site are provided in Section 2.3.1. {The location of groundwater monitoring wells are provided in Figure 2.3.1-40 (for the construction site), Figure 2.3.2-13 (for other existing wells onsite), and Figure 2.3.2.-18 (for regional monitoring wells). The existing thermal and biological monitoring stations are discussed in Section 6.1 and Section 6.6 for surface water. No thermal or biological monitoring stations exist for groundwater and none are planned. Figures showing major geomorphic features and regional geology are shown in Section 2.3.1 and Section 2.6.}

6.3.1 PREAPPLICATION MONITORING

{Hydrological monitoring at the CCNPP site includes both surface water and groundwater. Both monitoring programs comply with and are controlled by regulatory permit requirements and conditions described below.}

6.3.1.1 Surface Water

{CCNPP Units 1 and 2 conduct hydrological monitoring of surface water in accordance with the National Pollutant Discharge Elimination System (NPDES) program (MDE, 2004). Flows from storm water and plant-associated activities such as equipment blowdown and various system effluents are measured at different monitoring locations. Table 6.3-1 lists the monitoring locations and the permit flow requirements. Refer to Section 6.6 for a description of the monitoring locations as well as the NPDES monitoring program data analysis and quality control procedures.

In addition, water withdrawn from the Chesapeake Bay that is used for plant system cooling is monitored as part of the Maryland Department of Environment (MDE) Water Appropriation and Use (WAU) permit program (MDE, 2000a). Flow is monitored monthly at the CCNPP Units 1 and 2 Intake Structure and reported to MDE semiannually.

Beginning in February 2007, ~~three of~~ five rounds of planned water samples were collected at the CCNPP Units 1 and 2 cooling water intake structure. During each sampling event, water samples were collected towards the end of the incoming (flood) and the outgoing (ebb) tides. Sample results and analytical parameters are presented in Table 2.3.3-8. Because of differences in analytical suites, not all results are directly comparable to the water quality samples collected by the Chesapeake Bay Program (CBP) as shown in Table 2.3.3-6. In general, the intake analyte concentrations and measurements are similar to the values measured in CBP water samples collected at the stations closest to the CCNPP (locations CB4.3W, CB4.3C, CB4.3E, and CB4.4) indicating that there are no significant pollutants in the influent cooling water for CCNPP Units 1 and 2.}

6.3.1.2 Groundwater

{The CCNPP site has five production wells that supply process and domestic water within the existing CCNPP Units 1 and 2 protected area. Nine additional site wells supply water for domestic and industrial use in out lying areas as discussed Section 2.3.2.2. MDE requires periodic monitoring of the five production wells as part of a site WAU permit (MDE, 2000b). Data are acquired monthly and reported semiannually. Section 2.3.2.2 describes the well locations, permit limits, and withdrawal volumes.

Forty groundwater observation wells were installed across the site as shown in Figure 2.3.1-40. They were completed in the Surficial aquifer and water-bearing materials in the Chesapeake Group. The wells were located in order to provide adequate distribution with which to determine site groundwater levels, subsurface flow directions, and hydraulic gradients beneath the site. Well pairs were installed at selected locations to determine vertical gradients. Field hydraulic conductivity tests (slug tests) were conducted in each observation well. Monthly water level measurements from the groundwater observation wells began in July 2006 and ~~will continue until~~were completed in July 2007.

To evaluate vertical hydraulic gradients, several observation wells were installed as well clusters. Well clusters are a series of wells placed at the same location, with each well monitoring a distinct water bearing interval. Four well clusters were installed to evaluate the hydraulic gradient between the Surficial aquifer and the Upper Chesapeake unit, and three well clusters were installed to evaluate the gradient between the Upper Chesapeake and Lower Chesapeake units.

Monthly water levels in the observation wells were measured to characterize seasonal trends in groundwater levels and flow directions for the CCNPP site. ~~Preliminary r~~Results are discussed and shown in Section 2.3.1. Additional information on bathymetric characteristics of surface water, soil and groundwater characteristics, and transient hydrological parameters in the site vicinity are discussed in Section 2.3.1. Section 3.4 discusses the cooling system employed and its operational modes. Section 3.6 discusses the type of sanitary and chemical waste retention method. Section 2.7 discusses the meteorological parameters in the vicinity.**}**

6.3.2 CONSTRUCTION AND PRE-OPERATIONAL MONITORING

{Hydrological monitoring during CCNPP Unit 3 construction will include both surface water and groundwater. Both monitoring programs will comply with regulatory permit requirements and conditions described below. The objective of each program will be to establish a baseline for evaluating potential hydrologic changes, monitor anticipated impacts from site preparation and construction, and detect unexpected impacts.**}**

6.3.2.1 Surface Water

Surface water onsite will be monitored as part of the {NPDES Construction General Permit} as described in Section 1.3. Conditions of the permit will include compliance with erosion/sediment control and storm water management plans, which will be detailed in a required Storm Water Pollution Prevention Plan (SWPPP). The SWPPP also requires inspections as well as monitoring and record keeping.

In addition, **{**Chesapeake Bay**}** surface water will be monitored during {construction of both the CCNPP Unit 3 intake and discharge structures as well as refurbishment of the Barge Unloading

Facility.} Monitoring will be part of the U.S. Corps of Engineers 401 permit as described in Section 1.3 to ensure compliance with applicable water quality (e.g., turbidity) and sediment transport requirements.

6.3.2.2 Groundwater

Groundwater monitoring during {CCNPP Unit 3} construction will include, as needed, data from groundwater observation wells installed across the {CCNPP} site as part of COL preapplication studies described in Section 2.3.1.2. The purpose will be to monitor the potential effects of dewatering on perched water levels.

{Some of the existing CCNPP Unit 3 area observation wells will be taken out of service prior to construction activities due to anticipated earth moving and construction requirements. Prior to construction activities, the observation well monitoring network will be evaluated in order to determine groundwater data gaps and needs created by the abandonment of existing wells. These data needs will be met by the installation of additional observation wells, if required. Additionally, the hydrologic properties and groundwater flow regimes of the shallow water bearing units (Surficial aquifer, and to a lesser extent, the Chesapeake units) will be impacted by the proposed earthmoving, regrading, and construction of infrastructure (buildings, parking lots, etc.). Revisions to the observation well network will be implemented to ensure that the resulting changes in the local groundwater regime from construction activities will be identified.

A WAU permit (COMAR, 2007) is expected to be acquired to address temporary dewatering, because the duration of the dewatering is expected to be greater than 30 days.}

Disturbances to existing drainage systems will be avoided, if possible. {Environmental controls (i.e., silt screens, dams, settling basins, and spill containment measures), will be implemented to reduce potential pollutants in storm water runoff and to minimize construction impacts to aquatic habitats. Prior to the start of construction, approval of storm water management and erosion/sediment control plans will be obtained in accordance with the NPDES Construction General Permit as described in Section 1.3. These controls will be incorporated into a Storm Water Pollution Prevention Plan (SWPPP). Similar to the existing SWPPP, storm water system manholes and handholds will continue to be periodically inspected and cleaned.}

6.3.3 OPERATIONAL MONITORING

Hydrological monitoring during {CCNPP Unit 3} operation will be designed, as needed, to monitor the potential impacts from plant operation as well as detect unanticipated operational impacts.

{During CCNPP Unit 3 operation, plant water supply will be from the Chesapeake Bay at a new intake structure adjacent to the existing CCNPP Units 1 and 2 intake structure. The principle potable (fresh water) source will be from desalination of Chesapeake Bay water. The Desalination Plant will provide all fresh water needs to CCNPP Unit 3 systems. Consequently, CCNPP Unit 3 operation will not require use of groundwater. Operation of the new Intake Structure, however, will require surface water monitoring and reporting as part of the WAU permit program as described in Section 1.3. In addition, discharge effluents to the Chesapeake Bay from CCNPP Unit 3 and Desalination Plant operation will require monitoring as discussed in Section 6.6.

The CCNPP Unit 3 Waste Water Treatment Plant (WWTP) would collect sewage and waste water generated from the portions of the plant outside the radiological control areas of the power block and would treat them using an extensive mechanical, chemical, and biological treatment processes. The treated effluent would be combined with the discharge stream from the onsite wastewater retention basin and discharged to Chesapeake Bay. The discharge would be in accordance with local and state safety codes. The dewatered sludge would be hauled offsite for disposal at municipal facilities. The treated waste water would meet all applicable health standards, regulations, and TMDLs set by the Maryland Department of the Environment and the U.S. EPA. Table 3.6-5 lists anticipated liquid and solid effluents associated with the sewage treatment plant. Parameters are expected to include flow rates, pollutant concentrations, and the biochemical oxygen concentration at the point of release.

Non-radioactive liquid effluents that could potentially drain to the Chesapeake Bay are limited under the NPDES permit. An anticipated list of permitted outfalls is included in Table 3.6-7. Other non-radioactive liquid waste effluents from sources including laboratory chemicals, laundry solutions and other decontamination solutions are listed in Table 3.6-8. Table 3.6-1 provides information on the various chemicals anticipated to be used for the various plant water systems. All of these chemical additives will have limiting discharge concentrations specified in the NPDES permit that will require monitoring.**}**

Chemical monitoring will be performed at the **{**new outfall**}** to assess the effectiveness of retention methods and effluent treatment systems, as well as to detect changes in water quality associated with plant operations. **{**Similar to CCNPP Units 1 and 2,**}** chemical monitoring will also be performed at **{**storm water runoff**}** outfalls and at internal monitoring points (i.e., sanitary waste effluents, wastewater retention basin influent and/or effluent). Effluent water chemistry will meet applicable Federal and State environmental regulatory requirements.

{Finally, NRC regulations do not explicitly require routine, onsite groundwater monitoring during plant operation. However, a recent nuclear industry initiative by the Nuclear Energy Institute (NEI) and Electric Power Research Institute (EPRI) and NRC assessment (NRC, 2006) of existing nuclear reactors indicates that regulations relating to groundwater monitoring during plant operation for present and future nuclear reactors may change.}

6.3.4 REFERENCES

{COMAR, 1972. Title 26, Subtitle 17, Water Management, Chapter 06, Water Appropriation or Use, Annotated Code Of Maryland Regulations (COMAR 26.17.06), 1972.

MDE, 2004. State Discharge Permit No. 02-DP-0817 (NPDES Permit No. MD0002399), Maryland Department Of Environment, Effective June 1, 2004.

MDE, 2000a. Water Management Administration, Water Appropriation and Use Permit No. CA71S001(03), Maryland Department of Environment, Effective July, 1, 2000.

MDE, 2000b. Water Management Administration, Water Appropriation and Use Permit No. CA69G010(05), Maryland Department Of Environment, Effective July 1, 2000.**}**

NRC, 2006. Liquid Radioactive Release Lessons Learned Task Force, Nuclear Regulatory Commission, Final Report, September 1, 2006.}

Table 6.3-1—{CCNPP Units 1 and 2 NPDES Hydrological Monitoring Program}

{Page 1 of 1}

Monitoring Station	Description	Parameter	Frequency	Sample Type
001	Once-through cooling water, various system sump and blowdown, reverse osmosis reject water, low volume waste, sewage treatment plant, storm water	Flow	Continuous	Recorded
101A	Sewage treatment plant	Flow	1/Week	Measured
102A	Low volume sources, sump water, and storm water	Flow	1/Month	Measured
103A	Auxiliary boiler blowdown	Flow	1/Year	Measured
104A	Demineralizer backwash (i.e., reverse osmosis rejects water)	Flow	1/Month	Measured
106A	Secondary cooling blowdown	Flow	1/Year	Measured
003	Intake screen backwash	Note (a)		
004	Intake screen backwash	Note (a)		
005	Pool filter backwash	Flow	1/Month	Measured

Note:
No flow requirements.

6.4 METEOROLOGICAL MONITORING

This section describes the meteorological monitoring program that will be implemented for the {Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 on the CCNPP site}. It includes the pre-operational meteorological monitoring program consisting of {the existing meteorological monitoring program for CCNPP Units 1 and 2} and the operational meteorological monitoring program. There are no unusual circumstances anticipated during site preparation and construction that require additional meteorological monitoring.

{CCNPP onsite meteorological data were used as described below.} The other source of meteorological data used was from the U.S. National Weather Service (NWS). This data is certified by the National Climate Data Center (NCDC, 2007). {As such, a description of the data collection program is not included. No other sources of data were used.

The meteorological conditions of the CCNPP site and the surrounding area are taken into account by using onsite (CCNPP) and offsite (NWS) data sources. The onsite meteorological program which has been taking data since the 1970's provides an extensive data base for pre-application monitoring.}

6.4.1 PREOPERATIONAL METEOROLOGICAL MEASUREMENT PROGRAM

{The pre-operational meteorological measurement program described herein for Calvert Cliffs Nuclear Power Plant (CCNPP) Unit 3 utilizes the existing operational meteorological measurement program and equipment established for CCNPP Units 1 and 2. Data from the CCNPP Units 1 and 2 operational meteorological measurement program were used in this analysis for CCNPP Unit 3. CCNPP Unit 3 is to be located approximately 2,000 ft (610 m) south of CCNPP Units 1 and 2.

This program was designed and maintained in accordance with the guidance provided in Safety Guide 23, "Onsite Meteorological Programs" (NRC, 1972). The pre-operational meteorological measurement program also meets the requirements of Regulatory Guide 1.23, Revision 1, "Meteorological Monitoring Programs for Nuclear Power Plants" (NRC, 2007), with the following deviations: no atmospheric moisture measurements (required for plants utilizing cooling towers), tower not sited at approximately the same elevation as finished plant grade, and tower, guyed wire, and anchor inspection performance of once every 5 years instead of an annual inspection for tower and guyed wire and an anchor inspection of once every 3 years. These deviations are discussed further in Section 6.4.7.}

6.4.1.1 Tower Location

{The meteorological tower for the CCNPP site is located in an open field off Calvert Cliffs Parkway north of the CCNPP Unit 1 and 2 Independent Spent Fuel Storage Installation (ISFSI). The elevation at the base of the tower is approximately 125 ft (38 m) above mean sea level.

Figure 6.4-1 shows the location of the meteorological tower as well as the topography of the CCNPP site. The meteorological tower has been sited for CCNPP Unit 1 and 2 according to the guidance provided in Safety Guide 23 (NRC, 1972). Figure 6.4-2 shows the general topographic features of the region.

The meteorological tower is located on level, open terrain at a distance at least 10 times the height of any nearby obstruction that exceeds one-half the height of the wind measurement with the exception of some trees that are located south of the tower. Even though there are no obstructions in any other sector and south is not the most prevalent wind direction, the tree heights and distances will be calculated and an evaluation performed to determine whether the trees should be removed. The tower is located far enough away from proposed CCNPP Unit 3 structures and topographical features to avoid airflow modifications. The terrain height difference between the meteorological tower and the CCNPP Unit 3 reactor area is approximately 40 ft (12 m). The distance between the meteorological tower and the CCNPP Unit 3 reactor is approximately 2,900 ft (884 m). Therefore, the terrain profile has a very gentle slope and has an insignificant impact on site dispersion conditions.**}**

6.4.1.2 Tower Design

{The meteorological tower is 197 ft (60 m) tall with a lattice frame. Data from instruments on the tower are sent to the Met Building which is located near the tower.

The meteorological tower is designed to be capable of withstanding wind speeds of up to 100 mph (44.7 m/sec).**}**

6.4.1.3 Instrumentation

{The tower instrumentation consists of wind speed, wind direction, and duplicate sets of aspirated temperature sensors located at 197 ft (60 m) and 33 ft (10 m) above ground level. A tipping bucket rain gauge is located approximately 30 ft (9.1 m) from the meteorological tower in an open field and a barometric pressure device is located in the Met Building. No moisture measurements (dew point or wet bulb temperature, relative humidity) are currently taken. Consequently, meteorological data needed in the analysis of the Ultimate Heat Sink and potential plumes from cooling tower operation will be taken from other sources.

CCNPP replaced their meteorological monitoring instrumentation in December 2005. The specifications of the previous instrumentation met or exceeded the accuracy and resolution requirements of the Regulatory Guide 1.23 Revision 1 (NRC, 2007).

The instruments are positioned on the meteorological tower in accordance with the guidance in Regulatory Guide 1.23, Revision 1 (NRC, 2007).

Table 6.4-1 provides the current meteorological instrument accuracy and resolution and compares them with regulatory guidance provided in Regulatory Guide 1.23, Revision 1, (NRC, 2007).

Signals from the sensors are collected and processed by two data loggers. Each data logger collects the data from the meteorological tower, and performs calculations of average values, wind direction sigma theta, and temperature difference between the 197 ft (60 m) and 33 ft (10 m) levels of the meteorological tower. The primary data logger sends the averaged data values to a personal computer (PC) that is dedicated to the meteorological measurement system. This PC is located in the Met Building and includes a printer for data output. The backup data logger is connected to a dial-up modem, which provides the capability for remote retrieval of meteorological data. The primary data logger and plant equipment are isolated from the telephone connection to the backup data logger.**}**

6.4.1.4 Instrument Maintenance and Surveillance Schedules

{The meteorological instruments are inspected and serviced at a frequency that assures at least a 90% data recovery rate for all parameters, including the combination of wind speed, wind direction, and delta temperature. The instrumentation specified in Regulatory Guide 1.23, Revision 1 are channel checked on a daily basis and instrument calibrations are performed semi-annually.

System calibrations encompass the entire data channel for each instrument, including recording devices and displays (those located at the tower, in emergency response facilities, and those used to compile the historical data set). The system calibrations are performed by either a series of sequential, overlapping, or total channel steps.**}**

6.4.1.5 Data Reduction and Compilation

{Wind and temperature data are averaged over 15 minute periods. The data loggers employ a validation mode that monitors the various sensors and activates alarms as necessary. The validation mode compares the data values from the 33 ft (10 m) and 197 ft (60 m) levels of the tower. The data loggers perform a daily check of the processor cards and will alarm if values are outside of specified limits.

Averaged data values from the data loggers are collected by the meteorological software, along with maximum and minimum values of ambient temperature and wind direction variance (sigma-theta). Hourly data values are determined from the 15 minute averaged values. Output options include various functions and averages as well as graphical displays.

The 15 minute averaged data are available for use in the determination of magnitude and continuous assessment of the impact of releases of radioactive materials to the environment during a radiological emergency (as required in 10 CFR 50.47 (CFR, 2007a) and 10 CFR 50 Appendix E (CFR, 2007b)). The hourly averaged data are available for use in:

1. Determining radiological effluent release limits associated with normal operations to ensure these limits are met for any individual located offsite.

2. Determining radiological dose consequences of postulated accidents meet prescribed dose limits at the Exclusion Area Boundary (EAB) and Low Population Zone (LPZ).

3. Evaluating personnel exposures in the control room during radiological and airborne hazardous material accident conditions.

4. Determining compliance with numerical guides for design objectives and limiting conditions for operation to meet the requirement that radioactive material in effluents released to unrestricted areas be kept as low as is reasonably achievable.

5. Determining compliance with dose limits for individual members of the public.

Annual summaries of meteorological data in the form of joint frequency distributions of wind speed and wind direction by atmospheric stability class are maintained onsite and are available upon request.

A summary of the 2000 through 2005 onsite meteorological data in the form of joint frequency distributions of wind speed and wind direction by atmospheric stability class are presented in Section 2.7. Wind roses (graphical depictions of joint frequency distribution tables) summarizing data from 1984 to 1992 for three National Weather Service (NWS) sites are also presented in Section 2.7.

A comparison of the CCNPP site and the Norfolk, Virginia, data (of the three NWS sites, the Norfolk, Virginia, site is closest to the Chesapeake Bay) reveals that both sites have the same prevailing wind direction – wind from the south-southwest. For the south-southwest wind direction, the wind speed is between 6.9 and 17.9 mph (3.1 and 8.0 mps) approximately 5% of the time at the CCNPP site and the wind speed is between 7.6 and 24.6 mph (3.4 and 11.0 mps) approximately 9% of the time at the Norfolk, Virginia, site. The most prevalent wind speed class at the CCNPP site, 4.7 to 6.7 mph (2.1 to 3.0 mps), occurs approximately 28% of the time. The most prevalent wind speed class at the Norfolk, Virginia, site, 7.6 to 12.5 mph (3.4 to 5.6 mps), occurs approximately 36% of the time. These results indicate that the CCNPP onsite data also represent long-term conditions at the site.}

6.4.1.6 Nearby Obstructions to Air Flow

{Downwind distances from the meteorological tower to nearby (within 0.5 mi (0.8 km)) obstructions to air flow were determined using U.S. Geological Survey topographical maps. Highest terrain is to the north and north-northwest. Lowest terrain is to the northeast, east-northeast, and east (Chesapeake Bay). Table 6.4-2 presents the distances to nearby obstructions to air flow in each downwind sector.

From the information provided in Table 6.4-2 and Figure 6.4-1 and Figure 6.4-2 and with the knowledge that the base of the tower is at an elevation of approximately 125 ft (38 m), it can be seen that there are no significant nearby obstructions to airflow.}

6.4.1.7 Deviations to Guidance from {Regulatory Guide 1.23

The pre-operational meteorological monitoring program for CCNPP Unit 3 complies with Regulatory Guide 1.23, Revision 1 (NRC, 2007), except as follows. No atmospheric moisture measurements are taken. Atmospheric moisture data needed in the analysis of the CCNPP Unit 3 Ultimate Heat Sink and potential plumes from CCNPP Unit 3 cooling tower operation will be taken from other sources. In addition, the meteorological tower is not sited at approximately the same elevation as finished CCNPP Unit 3 grade. This was done in order to assure that the meteorological tower is located on level, open terrain at a distance at least 10 times the height of any nearby obstruction that exceeds one-half the height of the wind measurement (i.e., the tower is located far enough away from CCNPP Unit 3 structures and topographical features to avoid airflow modifications). Further discussion is provided in Section 6.4.1.1.

The tower, guyed wire, and anchor inspections are performed once every 5 years instead of an annual inspection for tower and guyed wire and an anchor inspection of once every three years as provided in Regulatory Guide 1.23, Revision 1 (NRC, 2007). Note that this was not a requirement stipulated in Safety Guide 23 (NRC, 1972). Tower and guyed wire inspections will be performed annually and anchor inspections will be performed once every 3 years.}

6.4.2 OPERATIONAL METEOROLOGICAL MEASUREMENT PROGRAM

{The operational meteorological measurement program for CCNPP Unit 3 is based on the operational meteorological measurement program for CCNPP Units 1 and 2 with the addition of revised operational procedures. This program was designed according to the guidance provided in Safety Guide 23 (NRC, 1972) and has been upgraded for CCNPP Unit 3 to comply with Regulatory Guide 1.23, Revision 1 (NRC, 2007).}

6.4.2.1 Tower Location

{The meteorological tower for the CCNPP site is located in an open field off Calvert Cliffs Parkway north of the CCNPP Unit 1 and 2 ISFSI. The elevation at the base of the tower is approximately 125 ft (38 m) above mean sea level. Figure 6.4-1 shows the location of the meteorological tower as well as the topography of the CCNPP site. The tower is sited according to the guidance provided in Regulatory Guide 1.23, Revision 1 (NRC, 2007). Figure 6.4-2 shows the general topographic features of the region.

The meteorological tower is located on level, open terrain at a distance at least 10 times the height of any nearby obstruction that exceeds one-half the height of the wind measurement; i.e., the tower is located far enough away from CCNPP Unit 3 structures and topographical features to avoid airflow modifications. The terrain height difference between the meteorological tower and the CCNPP Unit 3 reactor area is approximately 40 ft (12 m). The distance between the meteorological tower and the CCNPP Unit 3 reactor is approximately 2,900 feet (884 m). Therefore, the terrain profile has a very gentle slope and has an insignificant impact on site dispersion conditions.**}**

6.4.2.2 Tower Design

{The meteorological tower is 197 ft (60 m) tall with a lattice frame. Data from instruments on the tower are sent to the Met Building which is located near the tower. The primary meteorological tower is designed to be capable of withstanding wind speeds of up to 100 mph (44.7 m/sec).**}**

6.4.2.3 Instrumentation

{The tower instrumentation consists of wind speed, wind direction, and duplicate sets of aspirated temperature sensors located at 197 ft (60 m) and 33 ft (10 m) above ground level. A tipping bucket rain gauge is located approximately 30 ft (9.1 m) from the meteorological tower in an open field and a barometric pressure device is located in the Met Building.

The instruments are positioned on the meteorological tower in accordance with the guidance in Regulatory Guide 1.23, Revision 1 (NRC, 2007).

Table 6.4-1 presents meteorological instrument specifications and compares them with regulatory guidance provided in Regulatory Guide 1.23, Revision 1 (NRC, 2007).

Signals from the sensors are collected and processed by two data loggers. Each data logger collects the data from the meteorological tower, and performs calculations of average values, wind direction sigma theta, and temperature difference between the 197 ft (60 m) and 33 ft (10 m) levels of the meteorological tower. The primary data logger sends the averaged data values to a personal computer (PC) that is dedicated to the meteorological measurement system. This PC is located in the Met Building and includes a printer for data output. The backup data logger is connected to a dial-up modem, which provides the capability for remote retrieval of meteorological data. The primary data logger and plant equipment are isolated from the telephone connection to the backup data logger. In addition, the averaged data values are transmitted to the appropriate locations for operational and emergency response purposes (CCNPP Unit 3 Control Room, Technical Support Center, Emergency Operations Facility) and shall be submitted to the NRC's Emergency Response Data System as provided for in Section VI of Appendix E to 10 CFR Part 50 (CFR, 2007b).**}**

6.4.2.4 Instrument Maintenance and Surveillance Schedules

{The meteorological instruments are inspected and serviced at a frequency that assures at least a 90% data recovery rate for all parameters, including the combination of wind speed, wind direction, and delta temperature. The instrumentation specified in Regulatory Guide 1.23, Revision 1 are channel checked on a daily basis and instrument calibrations are performed semi-annually.

System calibrations encompass the entire data channel for each instrument, including recording devices and displays (those located at the tower, in emergency response facilities, and those used to compile the historical data set). The system calibrations are performed by either a series of sequential, overlapping, or total channel steps.

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6.4.2.5 Data Reduction and Compilation

{Wind and temperature data are averaged over 15 minute periods. The data loggers employ a validation mode that monitors the various sensors and activates alarms as necessary. The validation mode compares the data values from the 33 ft (10 m) and 197 ft (60 m) levels of the tower. The data loggers perform a daily check of the processor cards and will alarm if values are outside of specified limits.

Averaged data values from the data loggers are collected by the meteorological software, along with maximum and minimum values of ambient temperature and wind direction variance (sigma-theta). Hourly data values are determined from the 15 minute averaged values. Output options include various functions and averages as well as graphical displays.

The 15 minute averaged data are available for use in the determination of magnitude and continuous assessment of the impact of releases of radioactive materials to the environment during a radiological emergency (as required in 10 CFR 50.47 (CFR, 2007a) and 10 CFR 50 Appendix E (CFR, 2007b)). The hourly averaged data are available for use in:

1. Determining radiological effluent release limits associated with normal operations to ensure these limits are met for any individual located offsite.
2. Determining radiological dose consequences of postulated accidents meet prescribed dose limits at the EAB and LPZ.
3. Evaluating personnel exposures in the control room during radiological and airborne hazardous material accident conditions.
4. Determining compliance with numerical guides for design objectives and limiting conditions for operation to meet the requirement that radioactive material in effluents released to unrestricted areas be kept as low as is reasonably achievable.
5. Determining compliance with dose limits for individual members of the public.

Annual summaries of meteorological data in the form of joint frequency distributions of wind speed and wind direction by atmospheric stability class are maintained onsite and are available upon request.

A summary of the 2000 through 2005 onsite meteorological data in the form of joint frequency distributions of wind speed and wind direction by atmospheric stability class is presented in Section 2.7.

The impact of data from the two consecutive annual cycles, including the most recent one year period on the site-specific meteorological data will be evaluated and results provided in an update to this COL application.

Wind roses (graphical depictions of joint frequency distribution tables) summarizing data from 1984 to 1992 for three NWS sites are also presented in Section 2.7.

A comparison of the CCNPP site and the Norfolk, Virginia, data (of the three NWS sites, the Norfolk, Virginia, site is closest to the Chesapeake Bay) reveals that both sites have the same prevailing wind direction – wind from the south-southwest. For the south-southwest wind direction, the wind speed is 6.9 to 17.9 mph (3.1 to 8.0 mps) approximately 5% of the time at the CCNPP site and the wind speed is 7.6 to 24.6 mph (3.4 to 11.0 mps) approximately 9% of the time at the Norfolk, Virginia, site. The most prevalent wind speed class at the CCNPP site, 4.7 to 6.7 mph (2.1 to 3.0 mps), occurs approximately 28% of the time. The most prevalent wind speed class at the Norfolk, Virginia, site, 7.6 to 12.5 mph (3.4 to 5.6 mps), occurs approximately 36% of the time. These results indicate that the CCNPP onsite data also represent long-term conditions at the site.**}**

6.4.2.6 Nearby Obstructions to Air Flow

{Downwind distances from the meteorological tower to nearby (within 0.5 mi (0.8 km)) obstructions to air flow were determined using U.S. Geological Survey topographical maps. Highest terrain is to the north and north-northwest. Lowest terrain is to the northeast, east-northeast, and east (Chesapeake Bay). Table 6.4-2 presents the distances to nearby obstructions to air flow in each downwind sector.

From the information provided in Table 6.4-2, Figure 6.4-1, and Figure 6.4-2 and with the knowledge that the base of the tower is at an elevation of approximately 125 ft (38 m), it can be seen that there are no significant nearby obstructions to airflow.**}**

6.4.2.7 Deviations to Guidance from Regulatory Guide 1.23

{The meteorological tower is not sited at approximately the same elevation as finished plant grade. This was done in order to assure that the meteorological tower is located on level, open terrain at a distance at least 10 times the height of any nearby obstruction that exceeds one-half the height of the wind measurement; i.e., the tower is located far enough away from CCNPP Unit 3 structures and topographical features to avoid airflow modifications. Further discussion is provided in Section 6.4.2.1.**}**

6.4.3 REFERENCES

{CFR, 2007a. Title 10, Code of Federal Regulations, Part 50.47, Emergency Plans, 2007.

CFR, 2007b. Title 10, Code of Federal Regulations, Part 50, Appendix E, Emergency Planning and Preparedness for Production and Utilization Facilities, 2007.

NRC, 1972. Onsite Meteorological Programs, Safety Guide 23 (Regulatory Guide 1.23 Revision 0), Nuclear Regulatory Commission, February 1972.

NRC, 2007. Meteorological Monitoring Programs for Nuclear Power Plants, Regulatory Guide 1.23, Revision 1, Nuclear Regulatory Commission, March 2007.}

Table 6.4-1—{Tower Instrument Specifications and Accuracies for Meteorological Monitoring Program (Preoperational and Operational) }

(Page 1 of 1)

Characteristics	Requirements*	Specifications
Wind Speed Sensor		
Accuracy	±0.2 m/s (±0.45 mph) OR ±5% of observed wind speed	±1%
Resolution	0.1 m/s (0.1 mph)	0.1 m/s (0.1 mph)
Wind Direction Sensor		
Accuracy	±5 degrees	±1.5 degrees
Resolution	1.0 degree	1.0 degree
Temperature Sensors		
Accuracy (ambient)	±0.5°C (±0.9°F)	±0.05°C (±0.09°F)
Resolution (ambient)	0.1°C (0.1°F)	0.1°C (0.1°F)
Accuracy (vertical temperature difference)	±0.1°C (±0.18°F)	±0.05°C (±0.09°F)
Resolution (vertical temperature difference)	0.01°C (0.01°F)	0.01°C (0.01°F)
Precipitation Sensor		
Accuracy	±10% for a volume equivalent to 2.54 mm (0.1 in) of precipitation at a rate < 50 mm/hr (< 2 in/hr)	±1%
Resolution	0.25 mm (0.01 in)	0.25 mm (0.01 in)
Time		
Accuracy	± 5 min	± 5 min
Resolution	1 min	1 min

♦ Accuracy and resolution criteria from Regulatory Guide 1.23, Revision 1

Table 6.4-2—{Distances from Meteorology Tower to Nearby Obstructions to Air Flow }
(Page 1 of 1)

Downwind Sector*	Approximate Distance miles (meters)
N	0.25 (402)
NNE	0.33 (531)
NE	N/A**
ENE	N/A**
E	N/A**
ESE	1 (1609)
SE	0.1 (161)
SSE	0.1 (161)
S	0.1 (161)
SSW	0.25 (402)
SW	0.33 (531)
WSW	0.1 (161)
W	0.25 (402)
WNW	0.33 (531)
NW	0.25 (402)
NNW	0.25 (402)

* With respect to True North
** Lower than tower base elevation and therefore no possible obstructions

Figure 6.4-1—{ CCNPP Site Map with Meteorological Tower Location}

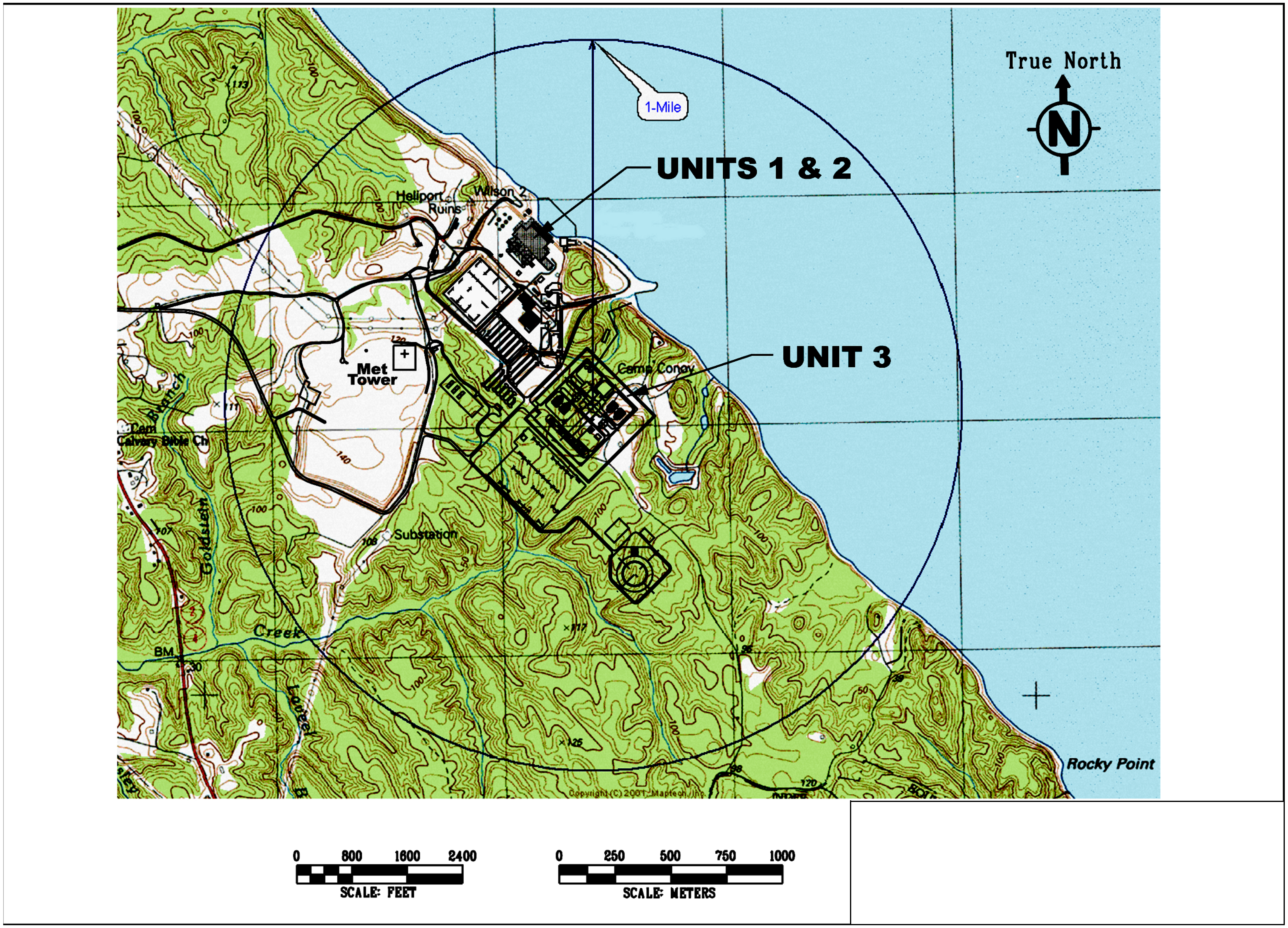
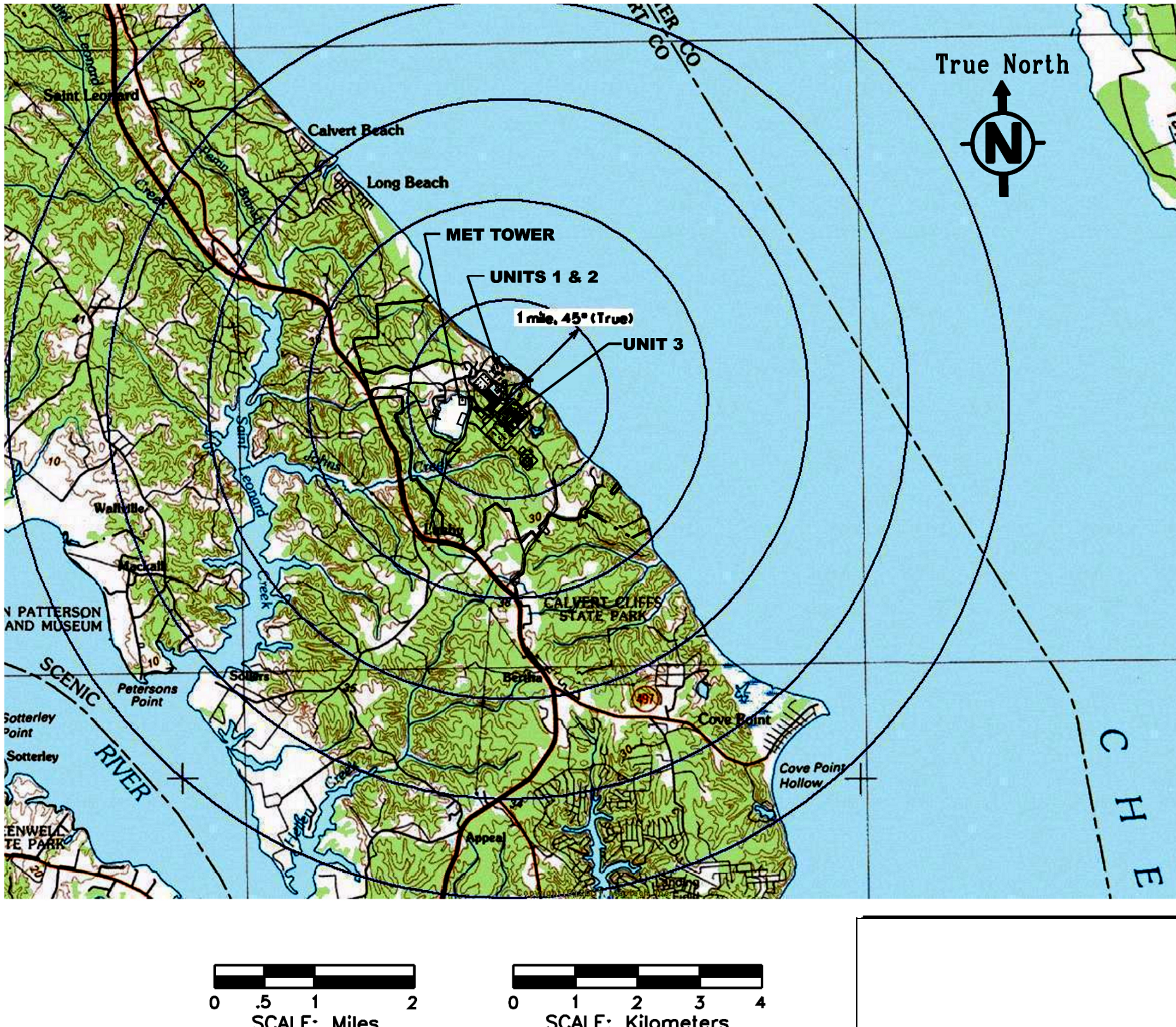


Figure 6.4-2—{Detailed Topography Within 5 mi (8 km)}



ER Section 6.0

6.5 ECOLOGICAL MONITORING

The following sections present information regarding ecological monitoring for terrestrial ecology, land use, and aquatic ecology of the {Calvert Cliffs Nuclear Power Plant (CCNPP) site} areas likely to be affected by site preparation, construction, and operation and maintenance of {CCNPP Unit 3}. The monitoring programs are designed based on anticipated environmental impacts through the various stages of {CCNPP Unit 3} project implementation. This section complies with NRC Regulatory Guide Sections 4.7 and 4.11 regarding general site suitability studies and terrestrial environmental studies to allow reasonably certain predictions that there are no significant impacts to the terrestrial ecology associated with the construction or operation of {CCNPP Unit 3.}

Monitoring programs to detect changes in the ecology begin before application submittal and continue during site preparation and construction and throughout station operation and maintenance. The monitoring programs cover elements of the ecosystem where a causal relationship between station construction and operation and adverse changes are established or strongly suspected. An evaluation of the standardization, adequacy and accuracy of data collection and analytical methods used in the monitoring programs is included.

6.5.1 TERRESTRIAL ECOLOGY AND LAND USE

The following sections present information on monitoring programs for terrestrial ecology and land use likely to be affected by site preparation, construction, or operation and maintenance of the facility. The monitoring programs are designed based on anticipated environmental impacts through the various stages of project implementation.

6.5.1.1 Preapplication Monitoring

Section 2.2.1 describes the site features and land use including a map showing these features. Section 2.2.2 describes the existing and proposed transmission line corridors and Section 2.4.1 describes the field studies performed to determine the major plant communities and important species and habitats. Note that the details of the type, frequency and duration of observations or samples taken at each location are contained in the individual reports for the field studies discussed in Section 2.4.1. The field studies and Section 2.4.1 discuss the distribution and abundance of important species and habitats. Critical life history information including parameters such as feeding areas, wintering areas and migration routes are also discussed in Section 2.4.1. Descriptions of modifications that may affect existing patterns of plant and animal communities including the development of cooling ponds and reservoirs, cooling towers, transmission line corridors and access routes is discussed in Section 4.3.1.

{Mitigation of the unavoidable wetland impacts will be guided by the permit requirements of the U.S. Army Corps of Engineers and Maryland Department of the Environment, according to the current regulations under Section 404 of the Federal Water Pollution Control Act and the Maryland Nontidal Wetlands Protection Act, respectively. Section 1.3 contains a list of the permits required for this project as well as the applicable Federal and State regulations. Monitoring of mitigation success will be defined and executed with reference to these regulations. All wetlands likely to be affected by CCNPP site preparation and construction associated with CCNPP Unit 3 were evaluated to determine their functions and values by a methodology accepted by the U.S. Army Corps of Engineers (USACE) (USACE, 1995) and the State of Maryland Department of Natural Resources. (MDE, 1995) Functions identified will be used as the basis of mitigating loss of wetlands during site development.}

As an essential record of overall project area baseline conditions, field surveys and aerial photography of the proposed site and transmission line system were obtained prior to construction. The resulting map of vegetation types by structure (e.g., herbaceous, shrub-scrub, sapling/small trees) and moisture regime (e.g., emergent wetland, droughty outcrops) serve as a guide to identify suitable habitats of Federal and State-listed species of plants and animals. {Following the results of a listed-species field survey, access roads and staging areas within the proposed site were located so as to avoid such habitats to the extent possible. Management plans will be prepared that aim to enhance or at least perpetuate the habitat for target species. Repeated aerial photography every five years including some field observations to verify the information gathered from photo interpretation will serve as a record of forest regrowth in restored areas after completion of construction as proposed in Section 4.3.1.4.} It would also provide evidence of any erosion around construction and other work areas, and indicate changes in vegetation that may call for corrective action (e.g., wind throws) or aid in the scheduling of routine transmission corridor right-of-way management.

{Additional baseline work included a survey for nesting activity of the Scarlet Tanager and other forest interior bird species and the Bald Eagle within 1,000 ft (330 m) of the proposed limits of work. Confirmation of breeding will follow accepted Federal and State protocols (Andrle, 1988).

There~~re are no continuous~~only monitoring programs required for terrestrial ecology and land use in this phase of the project is to monitor bald eagle nesting activity. The surveys and studies performed to establish baseline conditions follow general guidelines published by the Maryland Department of Natural Resources as referenced in the field study reports.}

6.5.1.2 Site Preparation, Construction and Pre-Operational Monitoring

{A description of site preparation and construction impacts on terrestrial resources, including wetlands, is discussed in Section 4.1. As noted in Section 4.3.1.1, the Showy Goldenrod population identified at Camp Conoy will be relocated to avoid destruction by the CCNPP Unit 3 site preparation and construction area. Since the power line right-of-way require periodic vegetation management, and the resulting open old-field herbaceous plant community accommodates the Showy Goldenrod's habitat requirement for strong light, transplantation of the Showy Goldenrod to an appropriate part of the ~~right-of-way or~~ the open fields on the CCNPP site, followed by periodic monitoring, will prove to be a cost-effective form of mitigation.

Mitigating wetlands lost to CCNPP site development will commence concurrently with project construction through the development of new surface impoundments. ~~Any monitoring required during site preparation, construction and preoperation will follow guidelines developed by the USACE and the State of Maryland in accordance with conditions specified in required permits listed in Table 1.3-1.~~

Following the completion of the on-site wetland in-kind creation and wetland enhancement activities, a five-year annual monitoring plan will be implemented pursuant to the MDE, Water Management Administration (WMA) mitigation guidelines and protocols. This effort will entail the establishment of sample plots and/or belt transects within the mitigation areas to obtain data on survivorship, growth, and vitality of the planted vegetation. Additional data to be reported at the mitigation areas include: (1) species composition of recruited, desirable plant species; (2) species compostion and area cover of nuisance/exotic plant species; (3) wildlife utilization and depradation; (4) hydrolic conditions (surface inundation or depth to groundwater); and (5) current site conditions at fixed photographic points.

The targets for the in-kind creation and enhancement efforts will be divided into two specific areas: (1) in-kind creation and enhancement of wetland communities and enhancement of stream reaches and (2) in-kind creation or sustainment of adequate hydrology. The species access criteria for the monitoring program will be identified prior to implementation of planting and monitoring activities, but will include at a minimum, the success of the planted vegetation, as measured through survivorship counts and observations of vitality and growth, and existence of adequate hydrology. If success criteria have been satisfied at the completion of the five-year monitoring program, a request for release from monitoring will be made to the US ACE and/or WMA.

Additional monitoring requirements including program elements, actions and reporting levels are specified in the CCNPP Stormwater Pollution Prevention Plan and the CCNPP Spill Prevention, Control and Countermeasures Program. This plan and program will be implemented during this phase in order to minimize impacts to wetlands, groundwater and aquatic ecology.

The Bald Eagle site survey will be conducted annually in this phase as well as annual monitoring for the first three years for the transplanted Showy Goldenrod locations in the transmission line corridor or open fields. Field observations versus a formal monitoring program will be documented for these surveys.

In accordance with the baseline studies performed during the preapplication time frame and existing plant experience at the CCNPP site, no additional monitoring programs are proposed for:

- Bird collisions with plant structures, transmission lines and towers, and cooling towers;
- Salt deposition impacts on vegetation growth and habitat modifications; and
- Impacts to important species and habitats.

These parameters have all been determined to have a small impact on terrestrial ecology as discussed in Section 4.1.1, Section 4.1.2 and Section 4.3.1. Note that there is a commitment to place flashing lights or reduce lighting on the large cooling tower to minimize bird collisions once this structure is built.

There are no continuous monitoring programs required for terrestrial ecology and land use in this phase of the project. The surveys to monitor changes to terrestrial ecology from baseline conditions will follow general guidelines published by the Maryland Department of Natural Resources as referenced in the field study reports.}

6.5.1.3 Operational Monitoring

{Operation and maintenance impacts of the proposed transmission system are addressed in Section 5.6.1.

The transplanted Showy Goldenrod population will be monitored annually for the first three years, and every five or ten years thereafter, depending on the perceived need at the transplanted locations in ~~the transmission line corridor or~~ open fields. The Bald Eagle survey will be performed every five years in this phase. The Maryland Natural Heritage Program's Rare Species Reporting Form will serve as the core protocol for data collection (MDNR, 2007). The State passes this information to the National Biological and Conservation Data System operated by NatureServe. Database standards and protocols controlled by NatureServe are followed (NS, 2007).

The wetland mitigation monitoring program discussed in Section 6.5.1.2 will continue until that request for release from annual monitoring is approved by the US ACE and/or WMA.

Repeated aerial photography backed by field observations every five years will serve as a record of forest re-growth discussed in Section 4.3.1.4. It would also provide evidence of any erosion around future construction and other work areas, and indicate changes in vegetation that may call for corrective action (e.g., wind throws) or aid in the scheduling of routine transmission corridor right-of-way management.

There are no continuous monitoring programs required for terrestrial ecology and land use in this phase of the project. The surveys to monitor changes to terrestrial ecology from baseline conditions will follow general guidelines published by the Maryland Department of Natural Resources as referenced in the field study reports.}

6.5.2 AQUATIC ECOLOGY

The following sections present information regarding ecological monitoring for aquatic ecology likely to be affected by site preparation, construction, or operation and maintenance of the facility. The monitoring programs are designed based on anticipated environmental impacts through the various stages of project implementation.

Section 2.3.3 documents the pre-existing water quality characteristics of {the freshwater bodies in the vicinity of the plant and the {Chesapeake Bay.} The principle aquatic ecological features of the {CCNPP} site and vicinity are described in Section 2.4.2, including freshwater systems on the {CCNPP} site and the intake and discharge areas of the {Chesapeake Bay.} Impacts to aquatic systems from construction of the facilities are described in Section 4.3.2. Impacts to aquatic systems from operation of the cooling system are described in Section 5.3.1.2 and Section 5.3.2.2. Impacts from waste discharges are described in Section 5.5.

6.5.2.1 Preapplication Monitoring

{Preapplication monitoring has been conducted, consisting of historical CCNPP Units 1 and 2 data, data collected and reported in Section 2.4.2, and the CCNPP Units 1 and 2 icthythoplankton in-plant entrainment and baffle wall study. The data provides a sufficient basis for describing the ecological resources existing on and in the vicinity of the CCNPP site. Sampling locations, sampling methods and quality control is discussed in these reports and in Section 2.4.2.

No rare or unique aquatic species were identified in nearby freshwater systems. The aquatic species that occur onsite are ubiquitous, common, and easily located in nearby waters. Typical fish species include the eastern mosquito fish and the bluegill and the American eel. The most important aquatic invertebrate species in the impoundments and streams are the juvenile stages of flying insects. Table 2.4-6 provides a list of important species and habitat found in the Chesapeake Bay. Figure 2.4-1 is a map showing open water areas.

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 to the Chesapeake Bay (CBP, 2006a).

Critical life history information including parameters such as spawning areas, nursery grounds, food habits, feeding areas, wintering areas, and migration routes are discussed in Section 2.4.2. Descriptions of modifications that may affect existing patterns of plant and animal communities such as dams, impoundments, dredging, filling of wetlands, and clearing of stream banks is discussed in Section 4.3.2.

There are no continuous monitoring programs required for aquatic ecology in this phase of the project. The surveys performed to establish baseline conditions follow the guidelines published by the Maryland Department of Natural Resources and the U.S. Department of Environmental Protection as referenced in the aquatic field study report}.

6.5.2.2 Construction and Pre-Operational Monitoring

{Construction and preoperational monitoring programs are proposed for resources that may affect aquatic ecology, including thermal monitoring (as discussed in Section 6.1), hydrological monitoring (as discussed in Section 6.3) and chemical monitoring (as discussed in Section 6.6). No aquatic ecology monitoring in addition to the current monitoring requirements for CCNPP Units 1 and 2 in the Chesapeake Bay are proposed during CCNPP Unit 3 site preparation and plant construction and preoperational monitoring mainly consists of drainage from excavations which are pumped to a storm water discharge point. Approval of storm water management and erosion/sediment control plans will be obtained in accordance with the National Pollution Discharge Elimination System (NPDES) permit. The Maryland Department of Environment will issue a new permit to include pollutants typically found at a construction site such as turbidity and petroleum hydrocarbons.

Storm water discharges from impervious surfaces at the new facility will be controlled and minimized by provisions of the Storm Water Pollution Prevention Plan. This plan calls for periodic monitoring and record keeping of the engineered controls to ensure they are effective in minimizing silt runoff and evaluating the need to repair or replace the installed controls such as silt fences, hay bales, berms and settling ponds. The U.S. Army Corps of Engineers 404 Permit may contain requirements for aquatic monitoring as it relates to chemical spills or control of silt discharging into water bodies. Implementation of the Spill Prevention, Control and Countermeasures Plan requires periodic monitoring and record keeping ensuring spill controls are established and maintained to minimize impacts to the aquatic environment.

Details as to monitoring program elements, sampling procedures and equipment, data analysis, quality control and reporting will be contained in the various permits and approvals required for construction.

CCNPP Unit 3 will be designed to meet the Phase I, New Facility requirements published at 40 CFR 125.80 to 89, under Track I (CFR, 2007a). The cited EPA requirements meet the Clean Water Act 316(b) (USC, 2002) (CFR, 2007a) rules to verify there will be minimal increases in fish and benthic community impingement and entrainment for the new intake structure.

The following monitoring requirements are required by 40 CFR 125.87 (CFR, 2007a):

Biological monitoring for both impingement and entrainment of the commercial, recreational, and forage base fish and shellfish species identified in the Source Water Baseline Biological Characterization data required by 40 CFR 122.21(r)(3) (CFR, 2007b) will be required for CCNPP Unit 3 in order to comply with Track I.

The monitoring methods used are consistent with those used for the Source Water Baseline Biological Characterization data required in 40 CFR 122.21(r)(3). The monitoring frequencies identified below are followed for at least 2 years after the initial permit issuance. After that time, the State of Maryland may approve a request for less frequent sampling in the remaining years of the permit term and when the permit is reissued, if supporting data show that less frequent monitoring would still allow for the detection of any seasonal and daily variations in the species and numbers of individuals that are impinged or entrained.

Impingement samples are collected to monitor impingement rates (simple enumeration) for each species over a 24 hour period and no less than once per month when the cooling water intake structure is in operation.

Entrainment samples are collected to monitor entrainment rates (simple enumeration) for each species over a 24 hour period and no less than biweekly during the primary period of reproduction, larval recruitment, and peak abundance identified during the Source Water Baseline Biological Characterization required by 40 CFR 122.21(r)(3) (CFR, 2007b). Samples are collected only when the cooling water intake structure is in operation.

Velocity monitoring is required for surface intake screen systems to monitor head loss across the screens and correlate the measured value with the design intake velocity. The head loss across the intake screen must be measured at the minimum ambient source water surface elevation (best professional judgment based on available hydrological data). The maximum head loss across the screen for each cooling water intake structure must be used to determine compliance with the velocity requirement in 40 CFR Section 125.84(b)(2) or 40 CFR Section 125.84(c)(1) (CFR, 2007c). Head loss or velocity is monitored during initial facility startup, and thereafter, at the frequency specified in the NPDES permit, but no less than once per quarter.

Visual or remote inspections are conduced using visual inspections or employing remote monitoring devices during the period the cooling water intake structure is in operation. Visual inspections are conducted at least weekly to ensure that any design and construction technologies required in 40 CFR Section 125.84(b)(4) and (5), or 40 CFR Section 125.84(c)(3) and (4) (CFR, 2007c) are maintained and operated to ensure that they will continue to function as designed. Alternatively, inspection via remote monitoring devices to ensure that the impingement and entrainment technologies are functioning as designed is required.**}**

6.5.2.3 Operational Monitoring

{Operational aquatic ecology monitoring will be required as a condition of a new NPDES permit (CFR, 2007d) and for compliance with the Clean Water Act 316(b) (USC, 2002). The permit will require flow and temperature monitoring and monitoring of certain chemical constituents in the discharge.

Data has been collected for over 30 years in support of CCNPP Units 1 and 2. Some biological entrainment data has also been collected, but there is currently no program to monitor aquatic organisms. Special Condition N of the CCNPP Units 1 and 2 NPDES permit (CCNPP, 2004) does require 24 hour notification of any impingement on the water intake apparatus of aquatic organisms substantial enough to cause modification to plant operations. In addition, several organizations monitor the aquatic ecology of the Chesapeake Bay as part of ongoing restoration programs. These programs are described in Section 2.4.2. None of these monitoring programs collect data in the vicinity of the plant and therefore are not applicable for baseline data or to augment monitoring data related to the plant intake and discharge effects.

The Clean Water Act Section 316(b) (EPA, 2007a) requires that the location, design, construction and capacity of a cooling water intake structure reflect the best technology available (BTA) (CFR, 2007d) for minimizing adverse environmental impacts. The Phase II Rule, 40 CFR 125, addresses existing sources of cooling water intake at steam electric plants. A Proposal for Information Collection (PIC) for CCNPP Units 1 and 2 was created accordance with 40 CFR Section 125.95(b)(1) of the Phase II Rule (CFR, 2007e). The PIC was prepared before the start of information collection activities and identifies a plan to address the information requirements of the Comprehensive Demonstration Study (CDS), 40 CFR 125.95(a)(2) (CFR, 2007e) to ensure that the CDS will meet the requirements of the Phase II Rule.

A separate NPDES application will be prepared and submitted for CCNPP Unit 3. The CCNPP Unit 3 cooling water intake structure is designed to meet the Clean Water Act Section 316(b) Phase I requirements for new facilities under Track 1 (closed cycle cooling and intake screen velocity less than or equal to 0.5 fps (0.15 mps)).

CCNPP Units 1 and 2 withdraw more than 50 million gallons per day (maximum 3,456 million gallons per day) from the Chesapeake Bay, thus subjecting it to the Phase II Rule. The performance standards for CCNPP Units 1 and 2 call for a minimum reduction of 80% for impingement mortality, and a minimum reduction of 60% for entrainment. These reductions are calculated from a theoretical baseline cooling water intake with no operational or design features for fish conservation. However, a recent court decision has remanded much of the Phase II rule back to EPA for reconsideration. Until this issue can be resolved, the EPA has requested permit writers to use “Best Professional Judgment” in writing NPDES permits. It is expected that the remanded Phase II rule will influence the Best Professional Judgment of the permit writers. CCNPP Units 1 and 2 are currently operating under State Discharge Permit No. 02-DP-0187, NPDES MD0002399, with a permit expiration date May 31, 2009. A new NPDES permit will be required for CCNPP Unit 3.

Impingement and impingement mortality were monitored at CCNPP Units 1 and 2 from the late 1970s through 1995. Results indicate the cooling water is withdrawn from an aquatic community that is typical of a mid-Atlantic estuary. Data from the last year sampled indicated Blue Crab and Bay Anchovy were the dominant species of all organisms collected. The highest impingement period was July through September during which 79% of all organisms for the year were collected. Implementing additional impingement and post-impingement studies is not planned at this time. Data collected during the 1990s provides an accurate baseline calculation as required by the Phase II Rule.

Entrainment data from April 1978 through September 1980 were examined for trends. Hogchoker was the dominant species, accounting for almost 75% of all organisms and life stages collected, with Bay Anchovy eggs and post larvae accounting for 19%. Entrainment survival studies during this time period have inconclusive results, with data including a range of species and life stages. Entrainment data will be collected for CCNPP Units 1 and 2 to supplement the 20 year old data that exists to determine the calculation baseline required by the Phase II Rule.

Circulating water for both Units 1 and 2 nuclear generating units is withdrawn through a single cooling water intake structure. The existing cooling water intake structure closely resembles EPA’s baseline definition with the following exceptions:

- a baffle wall sits in front of the screens to withdraw water from lower in the water column, potentially reducing impingement and entrainment rates,
- the existing traveling water screens reduce impingement mortality by returning fish and debris back to the Chesapeake Bay,
- the facility is operational at reduced flow, when necessary, with minimal losses in generation, which in turn reduces entrainment by a commensurate amount and measurably reduces impingement,

- ♦ two of the screens are dual-flow screens with a low pressure spray wash that potentially reduces impingement mortality.

While the addition of the new unit would increase water withdrawal, discharge rates, and thermal loading to the Chesapeake Bay, operation of the additional new unit would not increase withdrawal and discharge rates substantially over existing conditions. The planned new intake and discharge locations are located in the vicinity of the existing intake and discharge structures. Therefore, no additional monitoring programs are recommended in addition to those required by the NPDES permit and 40 CFR 125.80 to 40 CFR 125.89 (CFR, 2007a). The NPDES permit is required for the entire duration of plant operation. The permit is required to be renewed every five years with provisions for updating monitoring programs and parameters, as necessary. The NPDES permit builds upon the methodology and informational outputs of the previous monitoring programs and studies.

As noted in Section 5.5.1.2, the discharges to surface waters from plant operations will include cooling water blow down, permitted wastewater from auxiliary systems, and storm water runoff. Concentrations of chemicals in the cooling water discharge will be controlled by the NPDES permit. Additional sanitary wastes from CCNPP Unit 3 operations will be accommodated at a new sewage treatment plant, with effluent discharge also controlled by an NPDES permit. Note that the additional surface water discharges from the new unit are expected to be minor compared to the existing once-through cooling water discharges for CCNPP Units 1 and 2. Additional intake water requirements will also be minor compared to the existing intake flow.

Storm water discharges from impervious surfaces at the new facility will be controlled and minimized by provisions of the Storm Water Pollution Prevention Plan and the Spill Prevention, Control and Countermeasures Plan. A Stormwater Pollution Prevention Plan is required to be implemented at an industrial site under Maryland Department of the Environment regulations (MDE, 2007) The plan is submitted with an application for a general storm water permit. The plan provides detailed descriptions of various best management practices that can be implemented on site to reduce stream channel erosion, pollution, siltation and sedimentation and local flooding. A Spill Prevention, Control and Countermeasures Plan is required by US EPA regulation 40 CFR 112 (EPA, 2007). The plan describes measures to prevent, contain and clean up oil, gasoline, and chemical spills All plans are certified by a Professional Engineer and kept on site available for inspection by the US EPA or the Maryland Department of the Environment

In addition, water withdrawn from the Chesapeake Bay is monitored as part of the Maryland Department of Environment Water Appropriation and Use permit program. This water will be used for makeup to plant cooling and to create potable water from the desalination plant. Flow is monitored monthly and reported semi-annually. Groundwater diversion is also controlled under a CCNPP site Water Appropriation and Use permit. CCNPP Unit 3 operation will not require use of groundwater. Discharge effluents from CCNPP Unit 3 and the desalination plant also are monitored under the NPDES permit.

A recent nuclear industry initiative by the Nuclear Energy Institute and NRC assessment (NRC, 2006) of existing nuclear reactors indicates that requirements related to groundwater monitoring during plant operation may change for present and future nuclear reactors. Therefore, this developing issue will continued to be followed and future requirements will be addressed, as applicable.**}**

ER Section 6.0

6.5.3 REFERENCES

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6.6 CHEMICAL MONITORING

Chemical monitoring of surface water is performed to control and minimize adverse impacts to the **{**Chesapeake Bay**}** and will be implemented in three phases: preapplication, construction and preoperational, and operational monitoring. The scope for each monitoring phase will be predicated by the findings for the preceding phase.

Section 6.1 discusses discharged wastewater temperature requirements and Section 6.3 discusses flow sampling requirements.

6.6.1 PREAPPLICATION MONITORING

{Preapplication monitoring provides a baseline for assessment of effects from pre-operation and operation of CCNPP Unit 3 on the aquatic environment in the vicinity of the CCNPP site. Information on past studies performed to determine thermal characteristics of Chesapeake Bay water are discussed in Section 6.1.

6.6.1.1 Surface Water

The following water quality databases, maintained by Federal agencies, State agencies, and non-profit groups, were accessed to locate available and applicable water quality data relevant to the Chesapeake Bay water in the area of the CCNPP site:

- Chesapeake Bay Program (CBP) Water Quality Database (1984 to present)
- Chesapeake Bay Institute (CBI) Water Quality Database (1949 to 1982)
- CBP Toxics Database
- Alliance Citizen Monitoring Database
- U.S. Geological Survey (USGS) River Input Monitoring Database
- USGS Monthly Stream Flow Data
- Susquehanna River Basin Commission (SRBC) Nutrient Assessment Program
- National Estuarine Research Reserve System (NERRS)
- CBP Nutrient Point Source Database

After examining these databases, the most available data was found within the CBP Water Quality Database (1984 to present). Using this database, the CBP manages water quality data recorded at monitoring stations throughout the Chesapeake Bay and its tributaries, including stations in the area of the CCNPP site. Data from three mainstream monitoring stations (identified on Figure ~~2.3.3-1~~ 2.3-81) north of the CCNPP site (CB4.3W, CB4.3C, and CB4.3E) and three mainstream monitoring stations south of the CCNPP site (CB4.4, CB5.1, and CB5.1W) were used to characterize seasonal water quality trends for the Chesapeake Bay waters within the vicinity of the CCNPP site. Water quality data presented in this report were therefore obtained from these monitoring stations using the CBP database, unless otherwise noted (~~SBP~~ CBP, 2007).

Data reviewed for this environmental report was based on water year (WY) 2005 (i.e., the natural, annual water cycle from October 2004 through September 2005). Availability of water quality data varies by parameter and not all data were collected at the same collection events. However, where possible, trends in the available data sets were evaluated for discussion herein. Quality assurance/ quality control methodologies utilized can be found at the CBP website. Values with quality assurance/quality control issues noted by CBP were not included.

Most of the Chesapeake Bay mainstream, all of the tidal tributaries, and numerous segments of non-tidal rivers and streams are listed as Federal Water Pollution Control Act (USC, 2007) Section 303(d) "impaired waters" largely because of low dissolved oxygen levels and other problems related to nutrient pollution (MDE, 2006a). The CCNPP site lies within the Lower Maryland Western Shore watershed, characterized by inflow from the Patuxent River, Fishing Creek, Parkers Creek, Plum Point Creek, Grays Creek and Grover Creek. According to the Maryland Department of Environment (MDE) listing of Section 303(d) waters, the Patuxent River is the only contributing water body within the watershed with Section 303(d) status. The discussion of Section 303(d) waters is limited to those in the watershed in the area of the CCNPP site. Although NUREG-1555 (NRC, 1999b) requests "State 303(d) lists of impaired waters," there are significant portions of state waters, including waters outside of Chesapeake Bay that are well removed from the CCNPP site and could not possibly be affected by discharges from the CCNPP site.

The Patuxent River Lower Basin was identified on the 1996 Section 303(d) list submitted to U.S. Environmental Protection Agency (EPA) by the Maryland Department of the Environment (MDE) as impaired by nutrients and sediments, with listings of bacteria for several specified tidal shellfish waters added in 1998, and listings of toxics, metals and evidence of biological impairments added in 2002 (USEPA, 2005). The Section 303(d) segments within the Patuxent River have been identified as having low priority (MDE, 2004). Only waters that may require the development of Total Maximum Daily Loads (TMDLs) or that require future monitoring need have a priority designation (MDE, 2004). Two approved TMDLs are already established within Calvert County, including TMDL of fecal coliform for restricted shellfish harvesting areas and a TMDL for mercury in Lake Lariat. While the current Section 303(d) list identifies the lower Patuxent River and greater Chesapeake Bay as low priority for TMDL development, it does not reflect the high level of effort underway to identify and document pollution loadings in the watersheds.

Pursuant to the Federal Water Pollution Control Act (USC, 2007), the water quality of effluent discharges to the Chesapeake Bay and its tributaries is regulated through the National Pollutant Discharge Elimination System (NPDES). CCNPP Units 1 and 2 maintain a current NPDES permit. When the permit required renewal in June 1999, the MDE was unaware of any major issue that would prevent the permit renewal, and it was granted at that time. At the time, the MDE noted that any new regulations promulgated by the U.S. EPA or the MDE would be included in future permits and those may include development and implementation of TMDLs (NRC, 1999a). NPDES data collected in 2005 was reviewed to determine the nature of effluent discharges from the CCNPP site. Discharge parameters including biologic oxygen demand, chlorine (total residual), chlorine (total residual, bromine), cyanuric acid, fecal coliform, oil and grease, pH, temperature, and total suspended solids, were reported. Based upon the data reviewed, all discharges were within the acceptable range and no discharge violations were reported (USEPA, 2006).

Based upon the data, the following water quality trends were evident.

- Seasonal fluctuations in ammonia concentrations were observed throughout the year; however the highest variability was observed during the summer months. A minimum concentration of 0.003 mg/l was recorded at nearly all six monitoring stations during all seasons, while a maximum concentration of 0.344 mg/l was recorded during the summer. The annual average concentration of ammonia was 0.074 mg/l.

- Nitrite concentrations reached their peaks in the fall at all six monitoring stations; the greatest absolute fluctuation was at monitoring station CB4.3C, also during the fall. The annual average concentration was 0.0134 mg/l. Nitrate concentrations fluctuated seasonally throughout the year, with peak concentrations reached in the spring at all six monitoring stations. The highest concentration was 0.971 mg/l at CB4.3W. The annual average concentration was 0.2014 mg/l.

- Concentrations of total organic nitrogen fluctuated, but did not show a defined seasonal trend. A minimum concentration, 0.2698 mg/l, was recorded at monitoring station CB4.4 during the summer, while a maximum concentration of total organic nitrogen, 1.2507 mg/l, was recorded at monitoring station CB4.3W, also during the summer. The annual average concentration of total organic nitrogen was 0.5066 mg/l.

- Orthophosphate and total phosphorus concentrations remained relatively stable throughout the year, with no notable spatial or temporal variations. The highest concentrations for both parameters was reached at CB4.3W during the summer, with concentrations of 0.0932 mg/l and 0.1223 mg/l for orthophosphate and total phosphorus, respectively. The annual average concentration of orthophosphate was 0.0103 mg/l. The annual average concentration of total phosphorus was 0.392 mg/l.

- Concentrations of Chlorophyll A varied substantially at five of the six monitoring stations during nearly all seasonal periods. Peak concentrations were generally reached in spring or summer. Monitoring station CB5.1W had the lowest peak concentrations and the lowest variability. A minimum concentration of 0.449 µg/l was observed at monitoring station CB4.4 in the fall; while a maximum concentration 53.827 µg/l was recorded at CB4.3W during the summer. This high concentration corresponds to a rise in total available organic nitrogen and orthophosphates within the surface waters. The annual mean concentration was 9.764 µg/l.

- Total suspended solids concentrations fluctuated widely throughout the year, reaching peak concentrations at four of the six monitoring stations during the spring. Minimum concentrations of 2.4 mg/l were recorded at several monitoring stations. The maximum concentration of 53.827 mg/l was recorded during the summer at monitoring station CB4.3W. The lowest annual mean total suspended solids were 6.57 mg/l at Station CB5.1W. The average total suspended solids at Station CB4.4, nearest to CCNPP, range from 7.71 mg/l in the fall to 30.40 mg/l in the winter. The annual mean concentration for the six monitoring stations was 9.06 mg/l.

- Surface water pH fluctuated throughout the year from 7.0 to 8.6, averaging 7.764 standard units, with the lowest values generally reached during spring and summer. The average low pH across the stations was 7.7 standard units; the average maximum was 8.4 standard units. No spatial variations are noted.

In response to concerns about nutrient pollution, the U.S. EPA developed Chesapeake Bay-specific water quality criteria for dissolved oxygen, water clarity, and Chlorophyll A in 2003. Chlorophyll A is an indicator parameter used to measure the abundance and variety of microscopic plants or algae that form the base of the food chain in the Chesapeake Bay (USEPA, 2003). Excessive nutrients can stimulate algae blooms, resulting in reduced water clarity, reduced amount of good quality food, and depleted oxygen levels in deeper water. Chlorophyll A is, therefore, used to evaluate attainment of various water quality criteria including dissolved oxygen and water clarity (USEPA, 2003). Based on the 2005 water quality data as shown in Table ~~2.3.3-6~~ 2.3-35, mesotrophic to eutrophic water conditions may have been present in the vicinity of CCNPP site during the spring and summer months, and indicated that water quality criteria for DO would not be attained for the spring months.

Beginning in February 2007, three of five planned water samples were collected at the CCNPP Units 1 and 2 cooling water intake structure. During each sampling event, water samples were collected towards the end of the incoming (flood) and the outgoing (ebb) tides. Sample results and analytical parameters are presented in Table ~~2.3.3-8~~ 2.3.-37 Because of differences in analytical suites, not all results are directly comparable to the water quality samples collected by the CBP as shown in Table ~~2.3.3-6~~2.3-35. In general, the intake analyte concentrations and measurements are similar to the values measured in CBP water samples collected at the stations closest to the CCNPP (locations CB4.3W, CB4.3C, CB4.3E, and CB4.4) indicating that there are no significant pollutants in the influent cooling water for CCNPP Units 1 and 2.

6.6.1.2 Groundwater

Forty (40) groundwater observation wells were installed across the CCNPP site. They were completed in the Surficial aquifer and water-bearing materials in the Chesapeake Group. The wells were located in order to provide adequate distribution with which to determine site groundwater levels, subsurface flow directions, and hydraulic gradients beneath the CCNPP site. Well pairs were installed at selected locations to determine vertical gradients. Field hydraulic conductivity tests (slug tests) were conducted in each observation well. Monthly water level measurements from the groundwater observation wells began in July 2006 and will continue until July 2007.

To evaluate vertical hydraulic gradients, several observation wells were installed as well clusters. Well clusters are a series of wells placed at the same location, with each well monitoring a distinct water bearing interval. Four well clusters were installed to evaluate the hydraulic gradient between the Surficial aquifer and the Upper Chesapeake unit, and three well clusters were installed to evaluate the gradient between the Upper Chesapeake and Lower Chesapeake units.**}**

Well water quality data are described in Section 2.3.3.2.

6.6.2 CONSTRUCTION AND PREOPERATIONAL MONITORING

{Chemical monitoring during construction will aid in controlling adverse impacts to the Chesapeake Bay and will provide additional water quality data that can be used to measure water-quality changes from operation of CCNPP Unit 3. Accordingly, chemical monitoring of surface water during construction related activities for CCNPP Unit 3 will be an extension of more than 30 years of pre-application monitoring. Construction and preoperational chemical monitoring will be performed during the planned two year and four year periods for site preparation and plant construction, respectively. Sample collection, laboratory analyses, data evaluation and reporting practices will comply with permit modifications.

Although storm water discharges will increase during construction, primarily due to water pumped from excavation sumps, disturbance to existing drainage systems will be avoided, if possible. Environmental controls (i.e., silt screens, dams, settling basins, and spill containment measures), will be implemented to reduce potential pollutants in storm water runoff and to minimize construction impacts to aquatic habitats. Prior to the start of construction, approval of storm water management and erosion/sediment control plans will be obtained in accordance with the NPDES Construction General Permit as discussed in Section 1.3. These controls will be incorporated into a Storm Water Pollution Prevention Plan (SWPPP). Similar to the existing plant's SWPPP, storm water system manholes and handholds will continue to be periodically inspected and cleaned.

Considering that the CCNPP Unit 3 footprint is in the vicinity of the former Camp Conoy site, as discussed in Section 2.2 and Section 3.1, the existing swimming pool will be demolished and Outfall 005 replaced or eliminated.

Groundwater monitoring (water level observation) of the CCNPP Unit 3 area is currently being implemented through the use of the groundwater observation wells installed in 2006 for the CCNPP Unit 3 site area subsurface investigation and through the periodic review of water levels from selected wells within the Calvert County Groundwater Level Monitoring Network. Some of the existing CCNPP Unit 3 area observation wells will be taken out-of-service prior to construction activities due to anticipated earth moving and construction requirements. Prior to construction activities, the observation well monitoring network will be evaluated in order to determine groundwater data gaps and needs created by the abandonment of existing wells. These data needs will be met by the installation of additional observation wells, if required. Additionally, the hydrologic properties and groundwater flow regimes of the shallow water bearing units (Surficial aquifer, and to a lesser extent, the Chesapeake units) will be impacted by the proposed earthmoving, regrading, and construction of infrastructure (buildings, parking lots, etc.). Revisions to the observation well network will be implemented to ensure that the resulting changes in the local groundwater regime from construction activities will be identified. No chemical monitoring is planned at this time for groundwater.

6.6.3 OPERATIONAL MONITORING

{Operational monitoring will commence from the date of the first appropriation and use of Chesapeake Bay water and first discharge and continue as long as required by the NPDES permit applicable for CCNPP Unit 3. Although operational monitoring elements will be developed in consultation with the MDE, it is anticipated that sampling locations, frequency and analyses will be similar to those for CCNPP Units 1 and 2.

Similar to the CCNPP Units 1 and 2 intake structure, the CCNPP Unit 3 intake structures will house debris screens, screen wash pumps, makeup water pumps and related equipment so that a new outfall for intake screen backwash will be likely. However, similar to CCNPP Units 1 and 2, chemical monitoring at the CCNPP Unit 3 intake and outfall will be limited by the new NPDES permit to certain chemical parameters to ensure the differences between the intake water and discharge water are within the limits specified in the permit.

Unlike the once-through cooling water system utilized by CCNPP Units 1 and 2, CCNPP Unit 3 will utilize a closed-loop cooling water system, resulting in significantly less discharge water. Fresh water for CCNPP Unit 3 will be supplied by a desalination plant, in lieu of groundwater. Prior to discharge into the Chesapeake Bay, normal cooling tower blowdown will be directed to a retention basin, provided as an intermediate discharge reservoir, and held for a period of time to reduce the concentration of solids and chlorine in the water. Essential Service Water System cooling tower blowdown, treated sanitary effluents, desalination plant discharge (brine), and other wastewater will also collect in the retention basin. Piping will transfer retention basin wastewater by gravity to the new discharge structure, which will provide a flow path for the discharge of water into the Chesapeake Bay via a submerged outfall.

The CCNPP Unit 3 Waste Water Treatment Plant (WWTP) would collect sewage and waste water generated from the portions of the plant outside the radiological control areas of the power block and would treat them using an extensive mechanical, chemical, and biological treatment processes. The treated effluent would be combined with the discharge stream from the onsite waster water retention basin and discharged to Chesapeake Bay. The discharge would be in accordance with local and state safety codes. The dewatered sludge would be hauled offsite for disposal at municipal facilities. The treated waste waster would meet all applicable health standards, regulations, and TMDLs set by the Maryland Department of the Environment and the U.S. EPA.

Table 3.6-3 lists anticipated liquid and solid effluents associated with the WWTP. Parameters are expected to include flow rates, pollutant concentrations, and the biochemical oxygen concentration at the point of release.

Non-radioactive liquid effluents that could potentially drain to the Chesapeake Bay are limited under the NPDES permit. Table 3.6-1 provides information on the various chemicals anticipated to be used for the various plant water systems. All of these chemical additives will have limiting discharge concentrations specified in the NPDES permit that will require monitoring.

Chemical monitoring will be performed at the new outfall to assess the effectiveness of retention methods and effluent treatment systems, as well as to detect changes in water quality associated with plant operations. Similar to CCNPP Units 1 and 2, chemical monitoring will also be performed at storm water runoff outfalls and at internal monitoring points (i.e., sanitary waste effluents, wastewater retention basin influent and/or effluent). Effluent water chemistry will meet applicable federal and state environmental regulatory requirements.

The following discussion provides a basis for the type of data and information that is expected to be required by the NPDES permit for CCNPP Unit 3. The CCNPP Units 1 and 2 NPDES permit specifies the monitoring conditions that the existing plant must meet to protect water quality. It is expected that NPDES permit requirements for CCNPP Unit 3 will be similar. Table 6.6-1 summarizes the required water sampling protocol for the existing monitoring stations. A map showing the monitoring station locations is provided in Section 6.1. Although the sampling station for Outfall 001 is located onshore, its discharge point is offshore (Special Condition A.1 of NPDES, 2004). Past and present chemical characteristics of monitoring station discharges are provided in Section 2.3.3. Well water not consumed by various plant systems discharges into the Chesapeake Bay via authorized Outfall 001 or Outfall 005.

Sampling for CCNPP Unit 3 NPDES permit requirements will be performed in accordance with the quality standards outlined in a Chemical Quality Assurance (QA) and Quality Control (QC) Program. This Chemical QA and QC Program will provide performance instructions for chemical/reagent control, instrumentation control, program control (e.g., sampling methodologies, analysis), minimum quantifiable concentration control, use and evaluation of charts, and data reporting.

Samples representative of the system or stream will be collected and preserved as necessary to prevent contamination or deterioration. Treated sewage effluent samples will be collected with an automatic compositor. Sampling and analytical methods will conform to procedures for the analysis of pollutants as identified in 40 CFR Part 136, “Guidelines Establishing Test Procedures for the Analysis of Pollutants." Toxicity testing will be conducted in accordance with procedures described in EPA/600/4-90/027F (USEPA, 1993). To ensure accuracy of measurements, monitoring and analytical instrumentation is maintained and periodically calibrated in accordance with manufacturer specifications or those per the Chemical QA and QC Program, whichever are more restrictive. The Chemical QA and QC Program will also provide instructions for calibration standards, prepared or purchased, used for preparing calibration curves and performing calibration checks. Statistical reliability will be achieved by calculating the mean and standard deviation of the data at a 95% confidence level. Data quality objectives include producing accurate, reliable and cost effective measurements and data, adequate for their intended use.

Monthly monitoring results will be summarized on Discharge Monitoring Reports and submitted to the MDE. Sampling data collected during pre-application monitoring serve to document existing water quality conditions.

There are currently no plans to monitor groundwater for chemicals during the operational phase of CCNPP Unit 3.}

6.6.4 REFERENCES

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Table 6.6-1—{NPDES Required Water Sampling Protocol for CCNPP Units 1 and 2}

(Page 1 of 2)

Monitoring Station[a]	Monitoring Location[b]	System(s) Sampled[b]	Parameter Sampled	Sample Type[i]	Sampling Frequency
Outfall 001[c]	Surge pit at end of Discharge Road near the northeast corner of the plant	Once-through Cooling Water Sewage Treatment Low Volume Waste, Sump Water and Storm Water Runoff Auxiliary Boiler Blowdown Reverse Osmosis Reject Water Secondary Cooling Blowdown	TRC[d]	Grab	1/Week
Monitoring Point 101A	Discharge for the de-chlorination chamber	Sewage Treatment	BOD	8 hour Composite	1/Week
			TSS	8 hour Composite	1/Week
			Fecal Coliform[e]	Grab	1/Week
			TRC	Grab	1/Week
Monitoring Point 102A[f]	Pipe outlet beside the Sewage Treatment Plant access road	Low Volume Waste, Sump Water Storm Water Runoff	TSS	Grab	1/Month
			Oil and Grease	Grab	1/Month
			pH	Grab	1/Month
Monitoring Point 103A[g]	Auxiliary Boiler Room	Auxiliary Boiler Blowdown	TSS	Grab	1/Year
			Oil and Grease	Grab	1/Year
			pH	Grab	1/Year
Monitoring Point 104A	Discharge from the neutralization tank	Reverse Osmosis Reject Water (Demineralizer Backwash)	TSS	Grab	1/Month
			Oil and Grease	Grab	1/Month
			pH	Grab	1/Discharge
Monitoring Point 106A[g]	Plant sample sink	Secondary Cooling Blowdown	TSS	Grab	1/Year
			Oil and Grease	Grab	1/Year
			pH	Grab	1/Year
Outfall 003[h]	Intake Structure	Intake Screen Backwash	N/A	N/A	N/A
Outfall 004[h]	Intake Structure	Intake Screen Backwash	N/A	N/A	N/A

Table 6.6-1—{NPDES Required Water Sampling Protocol for CCNPP Units 1 and 2}

(Page 2 of 2)

Monitoring Station[a]	Monitoring Location[b]	System(s) Sampled[b]	Parameter Sampled	Sample Type[i]	Sampling Frequency
Outfall 005[j]	Plastic pipe across road north of pool	Swimming Pool Filter Backwash	TRC	Grab	1/Month
			TRB	Grab	1/Month
			Cyanuric Acid	Grab	1/Month

Notes:

a. Refer to Section 6.1 for a map showing the location of the monitoring stations. The sampling location for Outfall 001 is onshore, but its discharge point is offshore.
b. Monitoring station locations and systems sampled are specified in the NPDES permit.
c. Includes discharges from internal Monitoring Points 101A, 102A, 103A, 104A and 106A.
d. The monthly Discharge Monitoring Reports indicate when chlorine compounds are not in use. Discharge of residual chlorine from any unit is limited to two hours per day.
e. Average limitations are calculated as Geometric Mean.
f. Limitations and monitoring requirements are applicable during periods of no storm water runoff.
g. Closed loop system. Makeup water is supplied by the reverse osmosis system. Monitoring is performed annually since the discharged water is essentially pure.
h. Since the water is not changed by the screen backwash process, it is not limited by the NPDES permit.
i. Grab sample" means an individual sample collected in less than 15 minutes. Grab samples collected for pH and TRC are analyzed within 15 minutes of time of sample collection. "Composite sample" means a combination of individual samples obtained at least at hourly intervals over a time period. Although 'time periods' as noted above and in Note 'j' below are specified for sample collection in the NPDES permit, the 'time of day' that samples are collected, is not mandated.
j. Discharge is to an unnamed tributary (a small swale) which flows into the Chesapeake Bay.

6.7 SUMMARY OF MONITORING PROGRAMS

This section summarizes the monitoring environmental programs described in Chapter 6. The summary is divided into three sections:

- Pre-application monitoring
- Construction and Pre-Operational monitoring
- Operational monitoring

6.7.1 PREAPPLICATION MONITORING

Pre-Application monitoring for {CCNPP Unit 3} will be fulfilled by {the ongoing thermal, radiological, hydrological, meteorological, and chemical monitoring programs (Sections 6.1 through 6.6) for the existing CCNPP Units 1 and 2}. This represents {30} years of monitoring for the site. Pre-application {ecological} monitoring was provided through field studies. Summaries of the pre-application monitoring activities are included in Tables 6.7-1 through 6.7-7.

6.7.2 CONSTRUCTION AND PREOPERATIONAL MONITORING

The current thermal, radiological, hydrological, meteorological, and chemical monitoring programs will be continued through the construction and preoperational phases of {CCNPP Unit 3. Construction and pre-operational ecological monitoring will be provided by follow-up field studies and monitoring of intake structure impingement and entrainment, and quality monitoring for water withdrawn from the Chesapeake Bay}. Summaries are included in Tables 6.7-1 through 6.7-7.

6.7.3 OPERATING MONITORING

While specific operational monitoring requirements and programs for {CCNPP Unit 3} have not yet been fully established, they will be similar to and tiered from or added to those monitoring programs described in the previous sections which currently monitor the impacts of {CCNPP Units 1 and 2} on the surrounding environment. Summaries are included in Tables 6.7-1 through 6.7-7.

The existing and future operational monitoring programs could be modified as a result of future consultations with state regulatory agencies. The need for modifications to established monitoring locations, parameters, collection techniques, or analytical procedures will be assessed prior to and during the course of operation, as is done now for {CCNPP Units 1 and 2}.

6.7.4 REFERENCES

None

Table 6.7-1—{Thermal Monitoring }

(Page 1 of 1)

Phase	Summary	Permit
Pre-Application	The National Pollutant Discharge Elimination System (NPDES) permit for CCNPP Units 1 and 2 requires thermal monitoring of plant discharges via Outfall 001, and provides a cooling water temperature increase limit of 12 °F (6.7 °C). Once-through cooling water for CCNPP Units 1 and 2 is discharged through tunnels approximately 400 yards (365.8 meters) offshore.	NPDES Permit issued for CCNPP Units 1 and 2
Construction and Pre-Operation	Construction and pre-operational thermal monitoring will be a continuation of the pre-application program. Construction related discharges will mainly consist of surface drainage that collects in sumps at the bottom of excavations, which will be pumped to a storm water discharge point. Consequently, no changes in thermal discharges are expected to the construction and preoperational monitoring program from those provided during the pre-application phase. The Maryland Department of Environment (MDE) will be notified of pending construction activities and approval of storm water management and erosion/sediment control plans will be obtained in accordance with the NPDES Construction General Permit.	General NPDES Construction Permit
Operation	CCNPP Unit 3 will utilize a closed-loop cooling systems. Thermal monitoring will be performed at the discharge structure outfall for CCNPP Unit 3, and will conform to the requirements of the NPDES permit issued for CCNPP Unit 3. It is anticipated that the location of the thermal monitoring station for the new outfall structure will be similar to the existing monitoring stations (i.e., near the intake screens and discharge structure).	NPDES Permit issued for CCNPP Unit 3 Operation

Table 6.7-2—{Radiological Monitoring }

(Page 1 of 1)

Pre-application monitoring for CCNPP Unit 3 site location will be provided by the existing Radiological Environmental Monitoring Program (REMP) for CCNPP Units 1 and 2. Annual reporting of these REMP activities, detected radioactivity, trends, and plant related impacts will continue through the construction and operation of CCNPP Unit 3. Existing sampler locations, sampling frequency, and type of analysis are described further in Tables 6.2-2 through 6.2-7.

Construction and pre-operational radiological monitoring will be a continuation of the pre-application monitoring program. Prior to commencing construction, an existing REMP air particulate and iodine sampler (A1) and a Thermoluminescence Dosimetry location (DR7) will be relocated to an area that is outside the construction footprint for CCNPP Unit 3 (see Figure 6.2-4 for monitoring locations). Also, three vegetation species sample locations (Ib4, Ib5, Ib6) that are located within the construction footprint for CCNPP Unit 3 (see Figure 6.2-1) will be relocated near the new location for sampler A1.

For the operational phase, an additional air particulate and iodine sampler and Thermoluminescence Dosimetry location will be provided at the SSW site boundary area to satisfy REMP siting criteria. A surface water sampler will also be provided near the CCNPP Unit 3 discharge point.

Effluent Exposure Pathways	REMP Sampling Media	Frequency	Phase
	Liquid Effluents		
Ingestion Fish	Commercial & Recreational Fish Species	In season, or semiannually if not seasonal	All Phases
{Ingestion Invertebrates	Commercial & Recreational Fish Species	In season, or semiannually if not seasonal	All Phases
Shoreline Exposure (External Direct)	Sediments from Shoreline	Semiannually	All Phases
Swimming & Boating (External Direct)	Surface Waters	Composite sample over one month period	All Phases
	Gaseous Effluents		
Cloud Immersion (External Direct)	Thermoluminescence Dosimetry (TLD)	At least quarterly	All Phases
Ground Plane (External Direct)	Thermoluminescence Dosimetry (TLD)	At least quarterly	All Phases
Inhalation	Air Particulate Sampling, Iodine Sampling	Continuous sampler with weekly sample collection	All Phases
Ingestion of Agricultural Products	Broadleaf Vegetation	Monthly during growing season	All Phases}

Notes:
1. No milk ingestion pathway. No milk animals within 5 mi (8 km) of the site. Meat ingestion is not a significant pathway contributor.
2. The REMP for CCNPP Unit 1 and 2 does not include groundwater monitoring. By design, there are no liquid effluent releases to groundwater or structures that discharge to groundwater. Therefore there is no human ingestion pathway associated with groundwater for CCNPP Unit 3.

Table 6.7-3—{Hydrological Monitoring }

(Page 1 of 1)

Phase	Surface Water	Groundwater
Pre-Application	Hydrological Monitoring of surface water is in accordance with the NPDES program. Table 6.3-1 lists monitoring locations and frequencies. Water from the Chesapeake Bay is used for plant system cooling in accordance with a water appropriation and use (WAU) permit.	Groundwater monitoring is conducted of five production wells that supply process and domestic water in the CCNPP Unit 1 and 2 protected area. Nine additional wells supply water for domestic and industrial use in the outlying areas. These are monitored in accordance with a WAU permit.
Construction and Pre-Operation	Surface water on site will be monitored as part of the NPDES Construction General Permit. Erosion/sediment control and storm water management will be monitored by the Storm Water Pollution Prevention Plan (SWPPP). Chesapeake Bay surface water will be monitored during construction of the CCNPP Unit 3 intake and discharge structures as part of the U.S. Army Corps of Engineers 404 permit.	Groundwater monitoring during construction of CCNPP Unit 3 will be conducted with groundwater observation wells installed across the CCNPP site as part of the COL pre-application studies. This is to monitor for potential dewatering of perched water levels. Generally, temporary dewatering is exempt from a WAU permit unless pre-established limits are exceeded.
Operation	During CCNPP Unit 3 operation, plant water supply will be from two sources. Makeup water for plant cooling will be withdrawn from the Chesapeake Bay at a new intake structure. Potable (fresh water) will be provided from a desalination plant using Chesapeake Bay water. Operation of the new intake structure and desalination plant, as well as discharge to the Chesapeake Bay, will require monitoring via WAU and NPDES permits.	The desalination plant will provide all fresh water needs for CCNPP Unit 3 under a WAU permit. CCNPP Unit 3 will not require use of groundwater.

Table 6.7-4—{Meteorological Monitoring }

(Page 1 of 1)

Phase	Primary Tower	Backup Tower	Additional Sensors	Detailed Descriptions
Pre-Application	Wind Speed Sensor, Wind Direction Sensor, Temperature Sensors, Precipitation Sensor	Wind Speed Sensor, Wind Direction Sensor, Temperature Sensors	A tipping bucket rain gauge is located about 30 ft (9.1 m) from the primary tower in an open field and a barometric pressure instrument is located in the Meteorology Building.	Table 6.4-1 Table 6.4-2
Construction and Pre-Operation	Wind Speed Sensor, Wind Direction Sensor, Temperature Sensors, Precipitation Sensor	Wind Speed Sensor, Wind Direction Sensor, Temperature Sensors	A tipping bucket rain gauge is located about 30 ft (9.1 m) from the primary tower in an open field and a barometric pressure instrument is located in the Meteorology Building.	Table 6.4-1 Table 6.4-2
Operation	Wind Speed Sensor, Wind Direction Sensor, Temperature Sensors, Relative Humidity Sensor (Added for CCNPP Unit 3), Precipitation Sensor	Wind Speed Sensor, Wind Direction Sensor, Temperature Sensors	A tipping bucket rain gauge is located about 30 ft (9.1 m) from the primary tower in an open field and a barometric pressure instrument is located in the Meteorology Building.	Table 6.4-3 Table 6.4-4

Notes:

1. Pre-Application, and Construction and Pre-Operation, meteorological monitoring to be performed as an extension of the existing meteorological monitoring program for CCNPP Units 1 and 2
2. Primary tower – 197 ft [60 m] and 33 ft [10 m] elevations above ground level
3. Backup Tower – 33 ft [10 m] elevation above ground level

Table 6.7-5—{Terrestrial Ecology Monitoring}

(Page 1 of 2)

Phase	Summary	Permits
Pre-Application	~~There are currently no program or regulatory requirements to monitor terrestrial ecology.~~ The only monitoring program for terrestrial ecology is to monitor bald eagle nesting activity on-site. Extensive terrestrial ecology field studies were performed during the pre-application phase, including studies for rare plants, flora, fauna, wetlands, and two federally threatened tiger beetles. These studies included baseline surveys of the scarlet tanager and other forest-interior birds, and the bald eagle within 1,000 ft of the construction area. Aerial photographic records of the project area have been performed to establish baseline conditions for vegetation types and moisture regimes, and to identify suitable habitats for Federal and State protected species of plant and animals. Mitigation of unavoidable wetland impacts due to construction activities for CCNPP Unit 3 will be guided by permit requirements of the US Army Corps of Engineers and Maryland Department of the Environment. Wetlands likely to be affected by construction will be evaluated to determine their functions and values by methodology accepted by the US Army Corps of Engineers and Maryland Department of the Natural Resources.	US Army Corps of Engineers Maryland Department of the Environment Maryland Department of the Natural Resources
Construction and Pre-Operation	There are no continuous monitoring program requirements for terrestrial ecology during this phase. Mitigation of wetlands lost to development will commence concurrently with project construction. Monitoring will follow guidelines developed by the US Army Corps of Engineers, State of Maryland permit requirements, the CCNPP Stormwater Pollution Prevention Plan, and the CCNPP Spill Prevention, Control and Countermeasures Program. A five-year annual monitoring plan for on-site wetland creation and enhancement activities will be implemented following a baseline survey to be conducted immediately following the planting of the mitigation areas. The Showy Goldenrod population at Camp Conoy will be relocated to avoid destruction during site preparation and construction of CCNPP Unit 3. Power line right-of-ways require periodic ~~vegetable~~ management. ~~and the resulting o~~Open old-field herbaceous plant community matches the Showy Goldenrod's requirements for transplantation. Relocation followed by annual monitoring for the first three years will be performed and will be documented as field surveys. Aerial photographic records will be obtained every five years, including some field observations, to verify the information gathered from photo interpretation. This will serve as a record of forest growth in restored areas following construction, identify areas of erosion, and indicate changes in vegetation that require corrective action. Bald eagle surveys will be performed annually during the construction and pre-operation phase.	US Army Corps of Engineers Maryland Department of the Environment Maryland Department of the Natural Resources

Table 6.7-5—{Terrestrial Ecology Monitoring}
(Page 2 of 2)

Phase	Summary	Permits
Operation	There are no continuous monitoring program requirements for terrestrial ecology during this phase. The wetland mitigation monitoring program will continue until the request for release from annual monitoring is approved by the US ACE and.or WMA. The transplanted Showy Goldenrod population will be monitored annually for the first three years following relocation, and every five or ten years thereafter, based on perceived need. A refined version of the Maryland Natural Heritage Program's Rare Species Reporting Form will serve as the core protocol for data collection. Aerial photographic monitoring, backed by field observations, will continue to be performed every five years during operations to serve as a record of forest growth, and to identify erosion or changes in vegetation requiring corrective action. Bald eagle surveys will be performed every five years during the operational phase.	US Army Corps of Engineers Maryland Department of the Environment Maryland Department of the Natural Resources Maryland Natural Heritage Program

Table 6.7-6—{Aquatic Ecology Monitoring}

(Page 1 of 2)

Phase	Summary	Permit
Pre-Application Monitoring	There are currently no program or regulatory requirements to monitor aquatic ecology. Extensive aquatic ecology field studies were performed during the pre-application phase. These studies evaluated submerged aquatic vegetation, sediment quality and benthic macroinvertebrates, and oysters. Other pre-application monitoring included review of historical data for CCNPP Units 1 and 2, and the CCNPP Unit 1 and 2 icthyplankton in-plant entrainment and baffle wall study Surveys performed to establish baseline conditions follow the guidelines published by the Maryland Department of Natural Protection and US Department of Environmental Protection, as referenced in the aquatic field study report.	None applicable
Pre-Operation and Construction Monitoring	Construction and pre-operation monitoring programs are proposed for resources that may affect aquatic ecology, including thermal monitoring (Section 6.1), hydrological monitoring (Section 6.3), and chemical monitoring (Section 6.6). The existing monitoring locations for Outfall 001 are expected to remain the same as those for pre-application monitoring (see Table 6.6-1 for location). Engineered controls minimizing silt runoff from impervious surfaces on the CCNPP Unit 3 construction site will be periodically monitored for effectiveness. The monitoring requirements of the Army Corps of Engineers 404 permit and the Spill Prevention, Control and Countermeasures Plan will be implemented as they relate to spills and spill controls, as required. Biological monitoring for fish impingement and entrainment of the commercial, recreational, and forage base fish and shellfish identified in the Source Water Baseline Characterization data will be performed to meet 40CFR122..21(r)(3), Tier I requirements. Impingment samples will be taken over a 24 hour period no less than once per month when the cooling water intake structure is in operation. Entrainment samples will be taken over a 24 hour period no less than bi-weekly during the identified period of primary reproduction, larval recruitment, and peak abundance when the cooling water intake structure is in operation.	General NPDES Construction Permit Army Corps of Engineers 404 Permit Spill Prevention, Control and Countermeasures Plan

Table 6.7-6—{Aquatic Ecology Monitoring}
(Page 2 of 2)

Phase	Summary	Permit
Operational Monitoring	Operational monitoring will be part of compliance with the new NPDES permit and the Clean Water Act 316(b) Phase II rule. The Phase II rule addresses existing sources of cooling water intake at steam electric plants. Entrainment data will be collected for CCNPP Units 1 and 2 to supplement older data that exists to determine the calculation baseline required by the Phase II Rule. A year long seasonally stratified entrainment sampling program that includes monitoring inside and outside of the baffle wall has been proposed. This will provide a baseline for implementation of the Phase II rule. Biological monitoring for fish impingement and entrainment of the commercial, recreational, and forage base fish and shellfish identified in the Source Water Baseline Characterization data will be performed to meet 40CFR122..21(r)(3), Tier I requirements. ♦ Impingment samples will be taken over a 24 hour period no less than once per month when the cooling water intake structure is in operation. ♦ Entrainment samples will be taken over a 24 hour period no less than bi-weekly during the identified period of primary reproduction, larval recruitment, and peak abundance when the cooling water intake structure is in operation. ♦ Velocity monitoring will be performed for surface intake screens that correlate the measure value with the design intake velocity at the minimum source water elevation. Monitoring will be performed during initial startup, and thereafter at the frequency specified in the NPDES permit, but no less than once per quarter Water withdrawn from the Chesapeake Bay will be monitored monthly in accordance with a Maryland Department of Environment Water Appropriation and Use (WAU) permit	NPDES issued for CCNPP Unit 3 Operations

Table 6.7-7—{Chemical Monitoring }
(Page 1 of 1)

Phase	Summary	Permit
Pre-Application	Pre-application chemical monitoring will be performed in accordance with the existing NPDES permit for CCNPP Units 1 and 2. Details of the existing chemical monitoring program are shown in Table 6.6-1. This includes the monitoring locations, systems sampled, parameter sampled, sample type, and sampling frequency	Existing NPDES permit for CCNPP Units 1 and 2
Construction and Pre-Operation	Construction and Pre-Operational chemical monitoring will be performed in accordance with the existing NPDES permit for CCNPP Units 1 and 2. Sample collection, laboratory analyses, data evaluation and reporting practices will comply, as needed, the General NPDES Construction Permit. A Storm Water Pollution Prevention Plan will be implemented for construction of CCNPP Unit 3.	General NPDES Construction Permit
Operation	Operational chemical monitoring of the new CCNPP Unit 3 outfall, stormwater runoff outfalls, and internal monitoring points (i.e., sanitary waste effluents, wastewater retention basin influent/effluent) will be conducted in accordance with the new NPDES permit for CCNPP Unit 3 to determine the effectiveness of the retention methods and effluent treatment systems and to detect changes in water quality associated with Unit 3 operations.	NPDES permit issued for Unit 3 Operations