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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 10ºF (5.6ºC) at maximum plant operating capacity. The current delta temperature limit of 12ºF (6.7ºC) 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 12ºF (6.7ºC). 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

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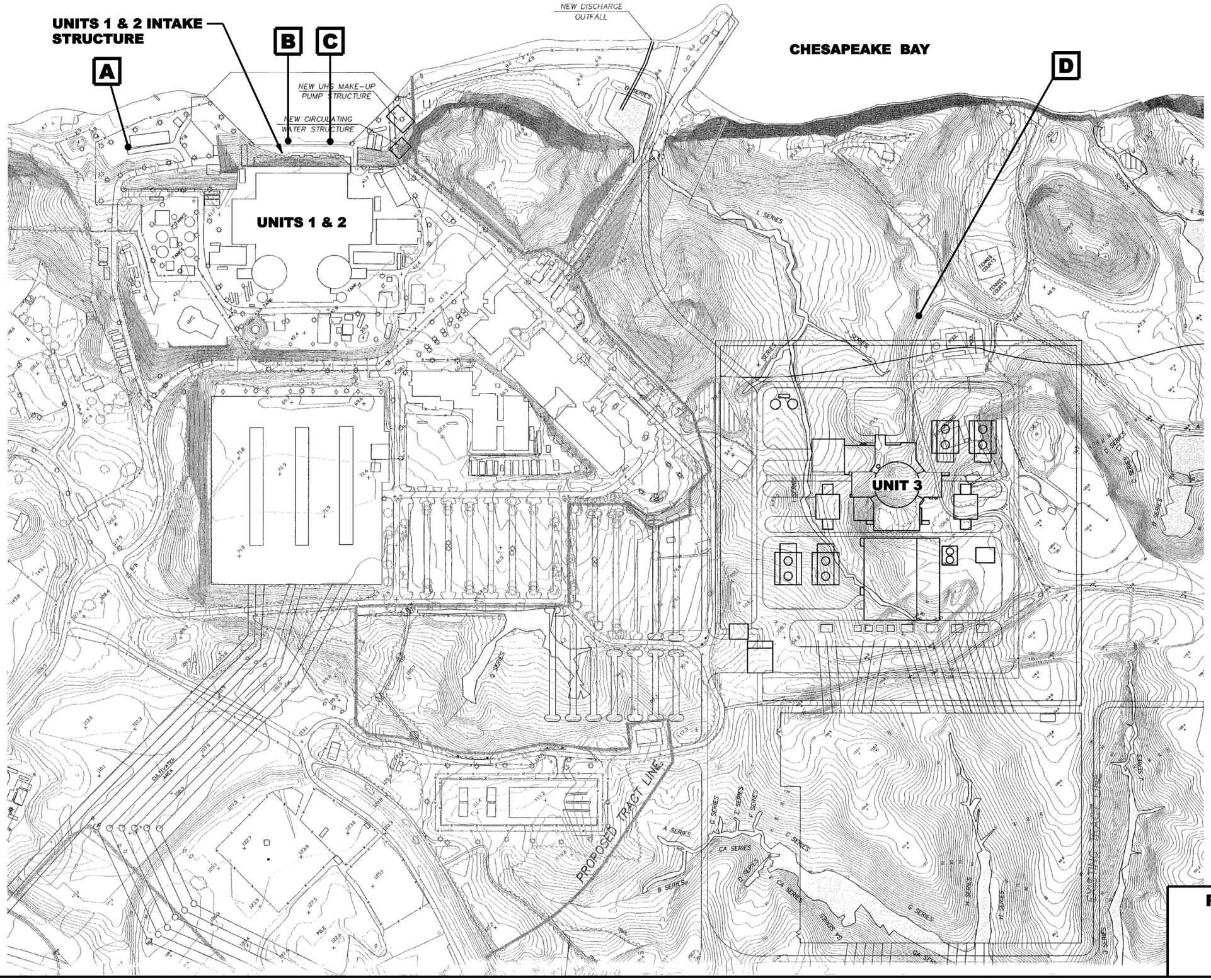

LEGEND:

- **A - Outfall 001 (MAIN DISCHARGE)**
- **B - Outfall 003 (INTAKE SCREEN BACKWASH)**
- **C - Outfall 004 (INTAKE SCREEN BACKWASH)**
- **D - Outfall 005 (SWIMMIMG POOL FILTER BACKWASH)**

0 250 500 1000

SCALE: Feet

0 75 150 300

SCALE: Meters

FIGURE 6.1-1 **Rev. 2**

EXISTING THERMAL MONITORING STATIONS FOR {CCNPP}

CCNPP UNIT 3 ER

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 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 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 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 insures 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 ENVIRIONMENTAL 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 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 Units 1 and 2 REMP will be included as part of the 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 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 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 Units 1 and 2 due to a lack of milk animals in the surrounding environment and will not be part of the 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 Units 1 and 2 and 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 Units 1 and 2, and Unit 3. Either a single joint report covering all three units on the CCNPP site, or two separate reports, one for Units 1 and 2 and one for 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, Interim Revision 2 (NRC, 2007).

{The REMP quality assurance program at CCNPP Units 1 and 2 prior to 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 (lb4, lb5 and lb6) 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 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

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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

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.

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
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
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

(Page 1 of 2)

Sample Site/Type	Sector	Distance		Description
		km	mi	
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 Driv
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

Table 6.2-3 {Existing Environmental Monitoring Sites for CCNPP

(Page 2 of 2)

Sample Site/Type	Sector	Distance		Description
		km	mi	
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

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 {Environmental Monitoring Sites for the ISFSI

(Page 1 of 2)

Station	Description	Distance (km)	Direction (sector)
		[Note: (a)]	[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

Table 6.2-5 {Environmental Monitoring Sites for the ISFSI

(Page 2 of 2)

Station	Description	Distance (km)	Direction (sector)
		[Note: (a)]	[Note: (a)]
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 2)

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

Table 6.2-6 {Lower Limits of Detection (LLD) for Environmental Media
(Page 2 of 2)

Direct Radiation	Parameter	Units	Frequency	LLD
	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

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.**}**

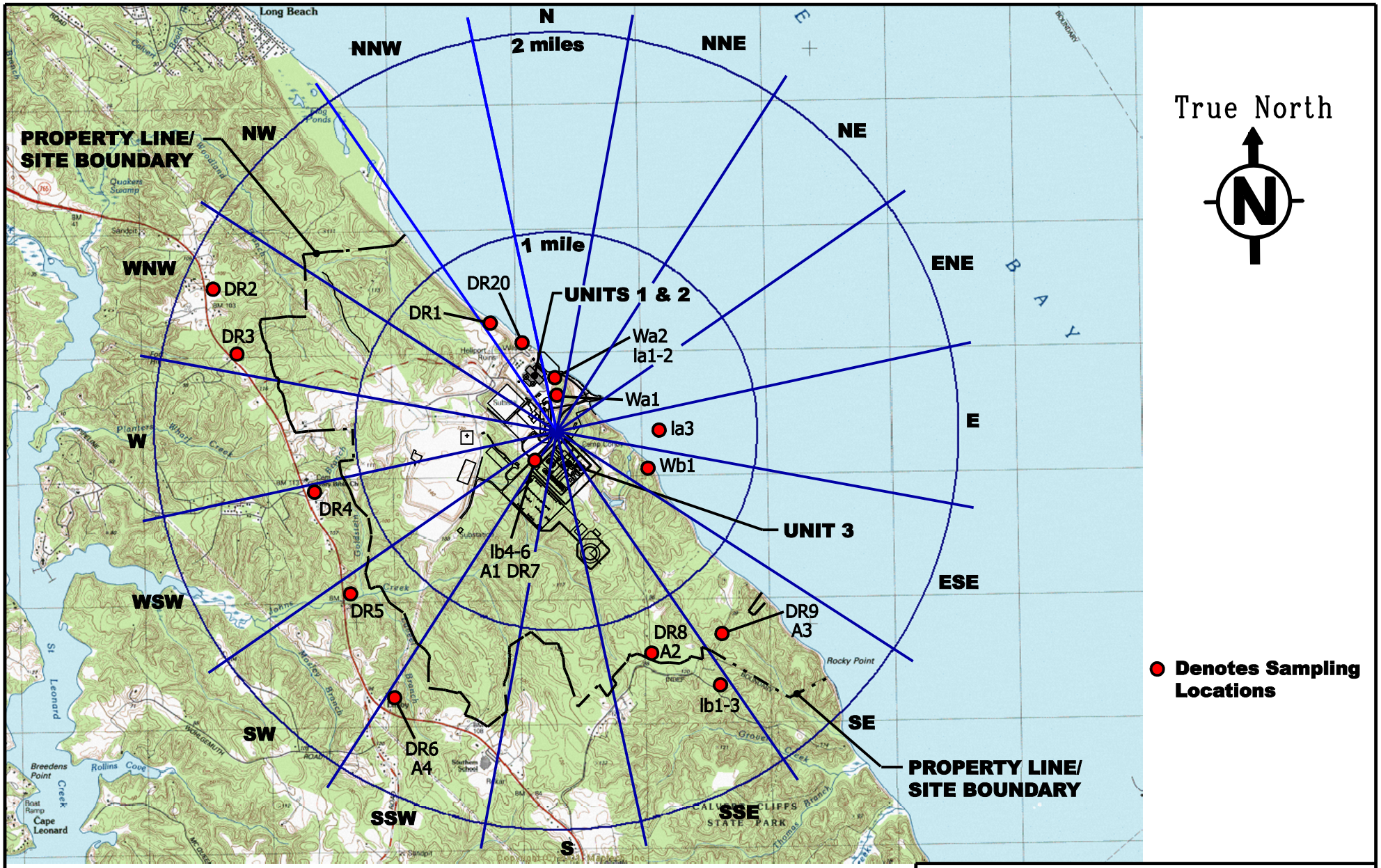

FIGURE 6.2-1 **Rev. 2**

{CCNPP} SAMPLING LOCATIONS
0–2 mi (0–3.2 km)

CCNPP UNIT 3 ER

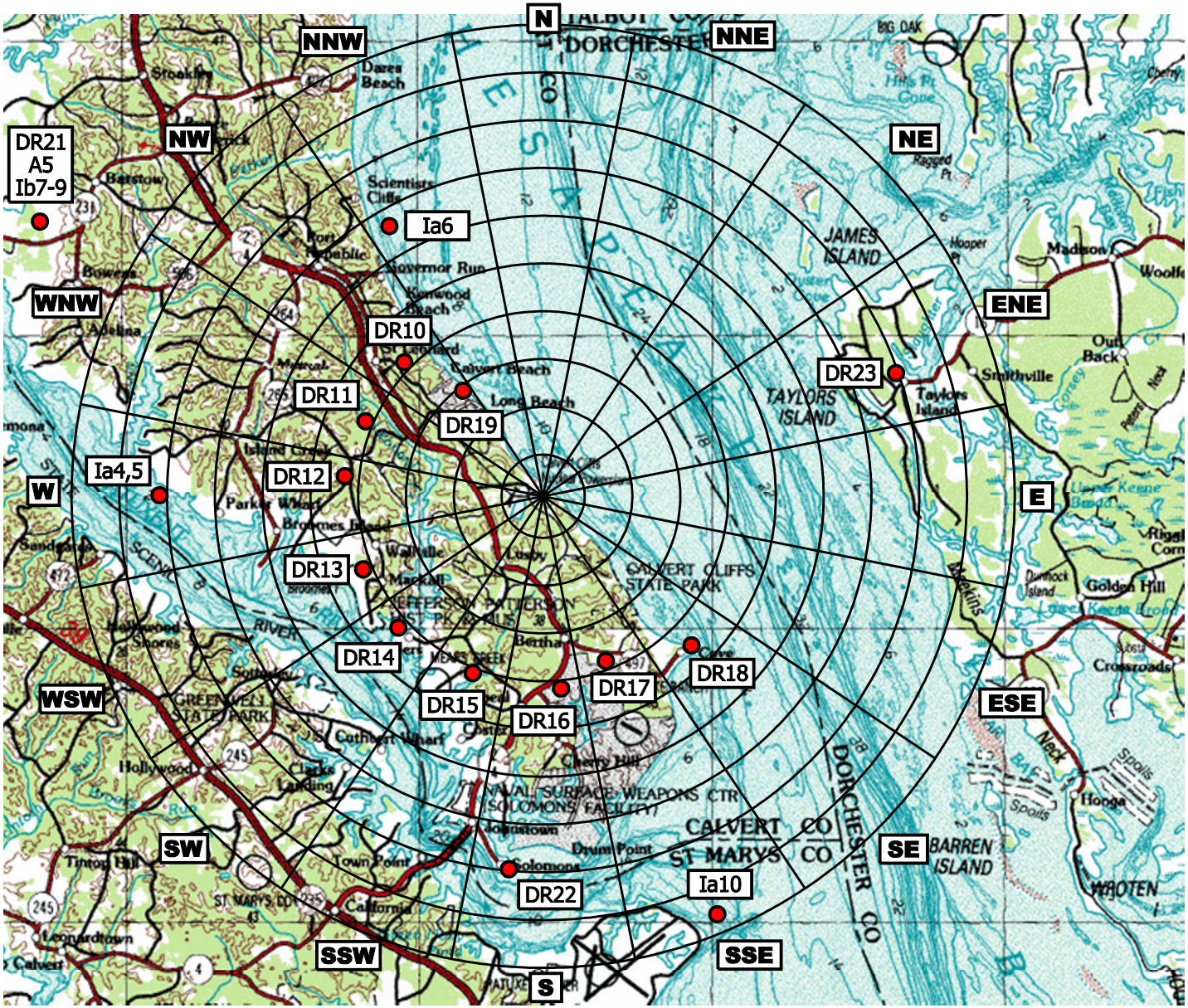

FIGURE 6.2-2 **Rev. 2**

{CCNPP} SAMPLING LOCATIONS
0–10 mi (0–16 km)

CCNPP UNIT 3 ER