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March 28, 2008

Ms. Terry J. Romine
Executive Secretary
Maryland Public Service Commission
William Donald Schaefer Tower
6 St. Paul Street, 16th Floor
Baltimore, Maryland 21202

Re: In the Matter of the Application of UniStar Nuclear Energy, LLC and UniStar Nuclear Operating Services, LLC for a Certificate of Public Convenience and Necessity to Construct a Nuclear Power Plant at Calvert Cliffs in Calvert County, Maryland – Case No. 9127

Dear Executive Secretary Romine:

Please find enclosed the original and 14 copies of the First Amendment to the Technical Report filed on behalf of the Co-Applicants. The amendment has been e-filed and served on all parties and interested persons on the Commission's service list. Also enclosed is an extra paper copy, which we ask that you date stamp and return in the envelope provided.

Very truly yours,

Robin D. Leone

Robin D. Leone
For the Co-Applicants

Enclosures

cc: Bryan Moorhouse, Chief Hearing Examiner
Lisa M. Decker, Esquire
Deborah E. Jennings, Esquire
Service List

CERTIFICATE OF SERVICE

I, Charles O. Monk, II, hereby certify that on this 28th day of March 2008, the foregoing First Amendment to the Technical Report filed on behalf of the Co-Applicants was served on all parties on the attached service list via first class mail.

Charles O. Monk, II

SERVICE LIST - CASE NO. 9127

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BEFORE THE
PUBLIC SERVICE COMMISSION
OF MARYLAND

IN THE MATTER OF:

APPLICATION OF UNISTAR NUCLEAR ENERGY, LLC	)	
AND UNISTAR NUCLEAR OPERATING SERVICES, LLC	)	
FOR A CERTIFICATE OF PUBLIC CONVENIENCE AND	)	**Case No. 9127**
NECESSITY TO CONSTRUCT A NUCLEAR POWER	)	
PLANT AT CALVERT CLIFFS IN CALVERT COUNTY,	)	
MARYLAND	)	

FIRST AMENDMENT TO THE TECHNICAL REPORT FILED BY UNISTAR NUCLEAR ENERGY, LLC AND UNISTAR NUCLEAR OPERATING SERVICES, LLC IN SUPPORT OF APPLICATION FOR A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY

On November 13, 2007, UniStar Nuclear Energy, LLC ("UNE") and UniStar Nuclear Operating Services, LLC ("UNO") (the "Co-Applicants") filed an Application for a Certificate of Public Convenience and Necessity and a Technical Report in support thereof ("Technical Report") to construct a nominal 1,710 MW nuclear power generation station and its associated overhead transmission lines ("Calvert Cliffs Unit 3") at the Calvert Cliffs Nuclear Power Plant ("CCNPP") site in Calvert County, Maryland. The Co-Applicants hereby amend the Technical Report as follows:

1. Amendment to List of Required Permits

In the Technical Report, Table 1.3-1, at the bottom of page 1-11, insert the following row:

Agency	Authority	Requirement	Approval Status	Waiver or Variance
DNR	COMAR 08.03.08	Coordination with DNR to comply with Natural Heritage Program requirements.		

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2. Amendments to Estimated Implementation Schedule

In the Technical Report, page 1-13, delete Table 1.4-1, and replace it with the revised Table 1.4-1 below.

Table 1.4-1 Rev. 1 Estimated Implementation Schedule for the Project

Milestone	Action	Completion Date
1	Submit Environmental Report to NRC	July 2007
2	Submit CPCN Application to Maryland Public Service Commission	November 2007
3	Start Detailed Engineering	Fourth Quarter 2007
4	Submit Design Certification Application to NRC for the U.S. EPR	December 2007
5	Submit Limited Work Authorization Application to NRC (if applicable)	TBD
6	Submit Remainder of COL Application to NRC	March 2008
7	Maryland Public Service Commission Issues CPCN	December 2008
8	Site Preparation Begins	December 2008
9	Non-Safety-Related Construction Begins	May 2009
10	NRC Issues Design Certification for U.S. EPR	October 2010
11	NRC Issues COL	March 2011
12	Full Plant Construction Begins	April 2011
13	Plant Construction Complete	July 2015
14	Plant Startup Testing Begins	July 2015
15	Commercial Operation Begins	December 2015

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3. **Amendments to Height of Reactor Building and Vent Stack**

a. In the Technical Report, the last paragraph on page 2-1, line 2, delete "230 ft (70.1 m)" and replace with "244 ft (74.3 m)."

b. In the Technical Report, page 2-2, lines 2 and 3, delete "190 ft (57.9 m)" and replace with "204 ft (62.2 m)."

c. In the Technical Report, page 2-2, lines 3 and 4, delete "275 ft (83.8 m)" and replace with "289 ft (88.1 m)."

d. In the Technical Report, page 2-2, paragraph 1, line 1, delete "197 ft (60 m)" and replace with "211 ft (64 m)."

4. **Amendments to Description of Laydown Areas**

The descriptions of construction laydown areas in the Technical Report have been conformed to the Co-Applicant's pre-filed testimony by employing the terms Laydown Area 1, Laydown Area 2, Laydown Area 3, Laydown Area 4, and the Lake Davies Area. These areas are identified in Figure 5.6-1 Rev. 1, which is attached hereto as Exhibit 1.

a. In the Technical Report, Table 5.2-1, page 5-5, line 5, column 1, delete the term "Permanent Laydown Area" and replace with the term "Laydown Area 1."

b. In the Technical Report, Table 5.2-1, page 5-5, line 6, column 1, delete the term "Parking Area" and replace with the term "Laydown Area 2."

c. In the Technical Report, page 5-16, Section 5.4.1.4, paragraph 1, line 3, delete the word "permanent."

d. In the Technical Report, page 5-16, Section 5.4.1.4, paragraph 2, lines 4 and 5, delete the phrase "permanent laydown area" and insert the phrase "Laydown Area 1."

e. In the Technical Report, page 5-17, paragraph 1, line 1, delete the word "temporary."

f. In the Technical Report, page 5-19, Section 5.4.2.2, bullet point 1, line 3, delete the word "permanent."

g. In the Technical Report, page 5-21, Section 5.4.2.3, bullet point 5, line 1, delete the words "temporary construction."

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5. Amendments to Water Usage During Construction

These amendments clarify that the Co-Applicants will not seek authorization to drill new wells to provide water during construction.

a. In the Technical Report, page 5-12, paragraph 3, line 1, replace the word "may" with the word "will."

b. In the Technical Report, page 5-12, paragraph 3, delete sentences 2 and 3.

6. Amendments to Figure 5.6-1 Updating Wetland Impacts

Replace Figure 5.6-1 (located on the tenth page after page 5-82) with Figure 5.6-1 Rev. 1 (Exhibit 1), which identifies the major construction areas.

a. In the Technical Report, page 5-43, line 13, delete "Figure 5.6-1" and replace with "Figure 5.6-1 Rev. 1."

b. In the Technical Report, Section 5.6.2, page 5-51, paragraph 2, line 1, delete "Figure 5.6-1" and insert "Figure 5.6-1 Rev. 1."

7. Amendments to Wetlands Overview

a. In the Technical Report, page 5-58, Section 5.6.3.1, delete sentence 2 and replace with the following sentence: "However, except to the extent that any opportunities to further reduce wetland impacts are identified during the detailed engineering process, the construction of the proposed facilities would not be possible without permanently filling approximately 10,199 linear feet (3,100 m) of intermittent and upper perennial stream channels and approximately 14.33 acres (5.79 hectares) of the delineated wetland areas."

b. In the Technical Report, page 5-59, paragraph 1, line 1, delete the introductory clause that provides "Because all of the affected wetlands are nontidal."

c. In the Technical Report, page 5-59, paragraph 1, line 3, delete "48" and "19.4" and replace with "38.82" and "15.68," respectively.

d. In the Technical Report, page 5-59, paragraph 2, delete sentences 1 and 2 and replace with "Most of the wetland fill would take place in Wetland Assessment Areas II, IV, and VII. Minor wetland impacts are proposed for Wetland Assessment Areas I, VI, and IX."

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e. In the Technical Report, page 5-59, paragraph 2, line 5, delete sentence 4 and replace with "No wetlands or nontidal wetland buffers would be disturbed in Wetland Assessment Area III, Wetland Assessment Area V, or Wetland Assessment Area VIII."

f. In the Technical Report, page 5-59, delete the nine bullet-pointed sentences under paragraph 2 and replace with the following ten bullet pointed sentences:

- Construction of the power block (reactor, turbine and safety-related structures) will impact 0.03 acres (0.01 hectares) of wetlands all of which is in Wetland Assessment Area I.
- Construction of Laydown Area 1 will impact 3.20 acres (1.29 hectares) of wetlands in Wetland Assessment Area II and 0.34 acres (0.14 hectares) of wetlands in Wetland Assessment Area IV.
- Construction of Laydown Area 3 will impact 0.32 acres (0.13 hectares) in Wetland Assessment Area VII.
- Use of the Lake Davies Area for construction and operation will impact 0.49 acres (0.20 hectares) of wetlands in Wetland Assessment Area VII.
- Construction of the cooling tower will impact 0.71 acres (0.29 hectares) of wetlands in Wetland Assessment Area IV.
- Construction of the switchyard will impact 2.93 acres (1.18 hectares) of wetlands in Wetland Assessment Area IV.
- Construction of on-site transmission lines will impact 0.14 acres (0.06 hectares) of wetlands in Wetland Assessment Area IV.
- The Unit 3 access road will impact 0.62 acres (0.25 hectares) of wetlands in Wetland Assessment Area VI and 0.59 acres (0.24 hectares) in Wetland Assessment Area VII.
- Construction of Laydown Area 2, followed by a parking lot, will impact 1.12 acres (0.45 hectares) of wetlands in Wetland Assessment Area IX.
- Construction of stormwater retention basins will impact 3.84 acres (1.55 hectares) of wetlands in Wetland Assessment Areas II, IV, and VII.

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g. In the Technical report, page 5-59, last line on the page, delete "5.6-4" and replace with "5.6-4 Rev. 1."

h. In the Technical Report, page 5-61, delete Table 5.6-4 and replace it with Table 5.6-4 Rev. 1, attached hereto as Exhibit 2.

8. Amendments to Wetland Assessment Area I

a. In the Technical Report, Section 5.6.3.2, page 5-62, paragraph 1, sentence 1, line 1, delete the words "and heavy haul road."

b. In the Technical Report, Section 5.6.3.2, page 5-62, paragraph 1, sentence 1, line 1, delete "0.92" and "0.37" and replace with "0.03" and "0.01," respectively.

c. In the Technical Report, Section 5.6.3.2, page 5-62, paragraph 1, sentence 2, lines 2 and 3, delete "2,160" and "658" and replace with "611" and "186," respectively.

d. In the Technical Report, Section 5.6.3.2, page 5-62, paragraph 1, sentence 2, lines 3 and 4, delete "totaling 0.90 acres (0.36 hectares)."

e. In the Technical Report, page 5-62, Section 5.6.3.2, paragraph 1, line 6, delete sentence 4, and replace it with the following sentence: "Construction of Retention Basin 5, near the barge dock, will not require filling of wetlands but will impact approximately 254 linear feet (77 m) of perennial stream channels."

f. In the Technical Report, page 5-62, Section 5.6.3.2, paragraph 1, line 8, delete "6.45" and "2.61" and replace with "2.71" and "1.09," respectively.

g. In the Technical Report, page 5-62, Section 5.6.3.2, paragraph 3, delete sentences 1 and 2 and replace with the following three sentences: "Grading to construct the power block will fill approximately 0.01 acres (0.004 hectares) of wetlands within the CBCA in Wetland Assessment Area I. However, no wetland impacts will occur within 100 ft (30.5 m) of mean high tide of the Chesapeake Bay shoreline, the CBCA buffer. Approximately 1.93 acres (0.78 hectares) of uplands in the CBCA designated by Calvert County as nontidal wetland buffer would also be impacted."

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9. Amendments to Wetland Assessment Area II

a. In the Technical Report, Section 5.6.3.3, page 5-62, paragraph 1, sentence 1, lines 1 and 2, delete "4.95" and "2.0" and replace with "3.20" and "1.29," respectively.

b. In the Technical Report, Section 5.6.3.3, page 5-62, paragraph 1, delete sentence 2 and replace with the following sentences: "Filled areas will include the Camp Conoy fishing pond as well as approximately 0.78 acres (0.32 hectares) of emergent wetlands and 1.49 acres (0.60 hectares) of forested wetlands fringing the pond. Stormwater Retention Basin 5 construction will total 1.74 acres (0.70 hectares). Currently, a total of 4.94 acres (2.0 hectares) of wetlands are proposed for impact in Wetland Assessment Area II."

c. In the Technical Report, Section 5.6.3.3, page 5-63, line 1, after the first word "Construction" insert the phrase "of Laydown Area 1."

d. In the Technical Report, Section 5.6.3.3, page 5-63, paragraph 1, line 2, after sentence 1, insert the following sentence: "The wetland impacts will be necessary for laydown and the construction of a retention basin."

e. In the Technical Report, Section 5.6.3.3, page 5-63, paragraph 1, line 2, delete "0.85" and "0.34" and replace with "0.86" and "0.35," respectively.

f. In the Technical Report, Section 5.6.3.3, page 5-63, paragraph 1, line 5, delete the word "stream" and replace with the term "wetlands complex."

10. Amendments to Wetland Assessment Area IV

a. In the Technical Report, page 5-64, Section 5.6.3.5, paragraph 1, delete sentences 1 and 2 and replace with the following: "Construction of the proposed switchyard will require permanently filling 2.93 acres (1.18 hectares) of wetlands and other waters of the state and U.S. in Wetland Assessment Area IV, including approximately 6,235 linear feet (1,895m) of intermittent and perennial stream channels, forested wetlands, and forested springs associated with a generally southwest-flowing headwater of Johns Creek. Wetland impacts for Stormwater Retention Basins 3 and 4 construction will total 0.50 acres (0.20 hectares)."

b. In the Technical Report, page 5-64, Section 5.6.3.5, paragraph 1, line 6, delete "15.3" and "6.2" and replace with "15.46" and "6.25," respectively.

c. In the Technical Report, page 5-65, paragraph 6, sentence 1, delete "0.31" and replace with "0.14," delete "0.13" and replace with "0.06," delete the

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parenthetical "(adjoining approximately 520 linear feet (158 m) of intermittent stream channel)," delete "1.85" and replace with "1.07," delete "0.75" and replace with "0.43."

d. In the Technical Report, page 5-65, paragraph 7, sentence 1, line 1, delete "0.79" and "0.32" and replace with "0.71" and "0.29" respectively.

e. In the Technical Report, page 5-66, after the partial paragraph at the top of the page, insert the following:

> Preparation of the proposed laydown area south of the power block (Laydown Area 1) will fill 0.34 acres (0.14 hectares) of Wetland Assessment Area IV. Filled areas will include upstream intermittent stream reaches of an unnamed tributary to Johns Creek.
>
> Construction of Laydown Area 1 would also disturb 7.18 acres (2.90 hectares) of uplands within 50 feet (15 m) of Wetland Assessment Area IV designated nontidal wetland buffer. The affected buffer consists mostly of undeveloped forested land.

11. Amendments to Wetland Assessment Area VI

a. In the Technical Report, page 5-66, Section 5.6.3.7, paragraph 1, lines 1, 3, and 5, respectively, delete "0.86" and "0.35" and replace with "0.62" and "0.25;" delete "0.50," "0.20," "0.36," and 0.15" and replace with "0.34," "0.14," "0.28," and "0.11;" and delete "1.12" and "0.45" and replace with "0.93" and "0.38," respectively.

b. In the Technical Report, page 5-66, Section 5.6.3.7, paragraph 1, lines 9 and 10, delete the phrase "temporary construction laydown" and replace with "use of the Lake Davies Area."

12. Amendments to Wetland Assessment Area VII

a. In the Technical Report, page 5-67, Section 5.6.3.8, paragraph 1, lines 1 and 2, delete "2.49," "1.0," "2,000," and "609" and replace with "0.59," "0.24," "2,499," and "760," respectively.

b. In the Technical Report, page 5-67, Section 5.6.3.8, paragraph 1, after sentence 3 and prior to sentence 4, line 7, insert the following: "Wetland impacts for Stormwater Retention Basins 1 and 2 construction will total 1.60 acres (0.65 hectares). A total of 3.00 acres (1.21 hectares) of wetlands and 3,099 linear feet (942 m) of stream channels are proposed to be impacted in Wetland Assessment Area VII."

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c. In the Technical Report, page 5-67, Section 5.6.3.8, paragraph 1, line 7, delete "8" and "13.3" and replace with "9.24" and "3.73," respectively.

d. In the Technical Report, page 5-67, Section 5.6.3.8, paragraph 1, line 9, delete "The affected buffer consists mostly of undeveloped forested land."

e. In the Technical Report, page 5-67, Section 5.6.3.8, paragraph 1, lines 9 and 10, delete "temporary construction."

13. Amendments to Wetland Assessment Area IX

a. In the Technical Report, page 5-67, Section 5.6.3.10, paragraph 1, delete sentence 1 and replace with the following sentence: "Construction of Laydown Area 2, to be followed by use as a parking lot, will require filling the entirety of Wetland Assessment Area IX, which is 1.12 acres (0.45 hectares), including 0.48 acres (0.19 hectares) of emergent wetlands and 0.64 acres (0.26 hectares) of forested wetlands."

b. In the Technical Report, page 5-67, Section 5.6.3.10, paragraph 1, lines 5 and 6, delete "3.34" and "1.35" and replace with "3.31" and "1.34," respectively.

14. Amendments to Proposed Mitigation Plan

a. In the Technical Report, page 5-69, Section 5.6.4, paragraph 1, line 10, insert the following sentence: "However, if additional opportunities to avoid impacts become apparent during the engineering and construction process, the Co-Applicants will strive to take advantage of such opportunities."

b. In the Technical Report, page 5-69, Section 5.6.4, delete paragraph 2 in its entirety and insert the following paragraph:

> The Co-Applicants will combine temporary erosion and sediment control stormwater management measures to: 1) reduce erosion using techniques including, but not limited to, temporary/permanent geotextile and vegetative slope stabilization, and 2) remove suspended sediment using techniques including, but not limited to, silt fencing, super-silt fencing, straw bales, check dams, geotextile and vegetative swale stabilization, and temporary sediment basins. The soil erosion and sediment control practices will reduce the risk of sediment runoff into intact wetlands adjoining the areas of fill. Additionally, permanent measures to manage discharge and sediment will be applied to minimize long-term impacts of development. These measures will include using progressive stormwater best management practices

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(BMPs) to regulate discharge and sediment to resemble a more natural pre-disturbance regime. BMPs, including sand filter ditches constructed around the periphery of the power block, construction laydown area, cooling tower, and switchyard areas, are intended to promote filtration of runoff from low intensity rainfall events. Also, retention and dry/wet detention basins will capture surface runoff preventing degradation of adjoining terrestrial and aquatic habitats. The stormwater retention basins may likely consist of unlined impoundments vegetated with regionally indigenous wetland grasses and herbs, with simple earth-fill closure on the downstream end and could include discharge piping to the adjacent watercourses.

c. In the Technical Report, page 5-69, Section 5.6.4, paragraph 3, line 2, delete the words "enhancement via stream bank stabilization" and insert "restoration."

15. Amendments to Wetland Creation, Enhancement, and Restoration

a. In the Technical Report, page 5-69, Section 5.6.4.1, delete paragraphs 1 and 2 in their entirety, and replace with the following paragraph:

The first component in the proposed compensatory wetland mitigation plan is onsite in-kind creation of forested wetlands located in the area of proposed Stormwater Retention Basin 5 between the existing tennis courts and the Camp Conoy fishing pond (Assessment Areas I and II). Approximately 5 acres (2 hectares) of forested wetlands will be created in this location. These "greentree reservoirs" will provide waterfowl habitat; i.e., winter flooded conditions for resident and migratory species, with drawdown in the spring to maintain the vitality of the planted tree species and provide a suitable substrate for plant regeneration. These greentree reservoirs will be designed to both retain the 1,000 year storm event and impound stormwater to achieve desired wetland hydroperiod. The basin will be planted with seedlings of hydrophytic tree and shrub species. This mitigation strategy will effectively satisfy the need to provide flood protection while also providing wildlife habitat for obligate and facultative wetland species.

b. In the Technical Report, page 5-70, paragraph 1, line 1, delete "2-acre mitigation site and the."

c. In the Technical Report, page 5-70, Section 5.6.4.2, paragraph 1, delete sentences 2 and 3 and insert "Approximately 5 acres (2 hectares) of emergent freshwater herbaceous wetlands communities within the existing sediment ponds southwest of the Lake Davies Area will be enhanced

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through the eradication of the phragmites and planting of native emergent species."

d. In the Technical Report, page 5-70, Section 5.6.4.2, paragraph 2, line 1, delete "20-acre" and replace with "5-acre (2-hectare)."

e. In the Technical Report, page 5-70, Section 5.6.4.3, delete paragraphs 1 and 2 and replace with the following paragraphs:

Until refined values of existing stream lengths are developed using best available information, we can now only estimate the proposed lengths of each treatment type.

Restoration, intended to establish function where it once existed but has since been lost, will include adjustment of horizontal/vertical channel alignment and channel cross section, and will be performed on approximately 6,850 linear feet (2,082 m) as follows: Conoy Creek ~ 250 linear feet (76 m); Lone Creek ~ 1,100 linear feet (334 m); Johns Creek (mainstem) ~ 550 linear feet (167 m); Johns Creek (unnamed tributary) ~ 1,200 linear feet (365 m); Woodland Branch upstream and downstream (mainstem, two locations) ~ 2,000 linear feet (608 m); and 1,750 linear feet (532 m), respectively. Additional restoration treatments include: instream habitat structures (cover logs, lateral/longitudinal diversity, root wads), bank stabilization (vegetative and bioengineering treatments) and riparian wetland enhancements (hydraulic and vegetative).

Stream enhancement activities intended to increase existing functions will include less intense grading operations, such as minor adjustments of horizontal alignment and channel cross section only at isolated features, and include: 1) improvements to aquatic habitat, 2) bank stabilization, and 3) native riparian planting. Enhancement activities will be performed on approximately 4,550 linear feet (1,383 m) as follows: Conoy Creek ~ 2,000 linear feet (608 m); Johns Creek (mainstem) ~ 500 linear feet (152 m); Woodland Branch (mainstem ~ 500 linear feet (152 m); Woodland Branch (unnamed tributaries, two total) 500 linear feet (152 m) and 1,050 linear feet (319 m). Additional opportunities for stream mitigation may exist at the lower end of Lake Davies.

f. In the Technical Report, Section 5.6.4.3, page 5-71, paragraph 1, line 1, delete "two."

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g. In the Technical Report, page 5-71, Section 5.6.4.4, line 1, delete "17" and "6.9" and replace with "5" and "2," respectively.

h. In the Technical Report, page 5-71, Section 5.6.4.5, paragraph 1, delete sentence 1 and replace with "Following the completion of the proposed mitigation activities, a five-year annual monitoring plan will be implemented pursuant to the MDE, Water Management Administration (WMA), mitigation monitoring guidelines and protocols and submitted to both the WMA and the U.S. Army Corps of Engineers."

16. Amendments to the Air Quality Impacts of Operation

In the Technical Report, page 6-22 through 6-35, delete the entirety of Section 6.5 and Figures 6.5-1 through 6.5-3 and insert the following and Figure 6.5-1 Rev. 1, attached hereto as Exhibit 3:

6.5 AIR QUALITY IMPACTS OF OPERATIONS

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

The U.S. EPR has four steam generators that feed high pressure steam to a manifold and subsequently to the turbine generator. After the steam passes through the turbine, it is cooled in the main condenser. The main condenser has three sections, one each for high pressure, medium pressure and low pressure steam. Chilled water from the CWS cooling tower (about 85° to 90°F) is used to condense the steam to water before being pumped back to the steam generator. The CWS cooling tower supplies about 777,560 gallons per minute to the main condenser. The cooling tower transfers waste heat contained in the CWS cooling water through direct contact with an air stream.

The CWS cooling tower design is based on an air flow rate of 66.5 million acfm in the wet section and, when required for visible plume abatement, air flow ranging up to 53.1 million acfm in the dry section. Makeup water is drawn from the Chesapeake Bay to offset evaporation, drift, and blowdown. The CWS cooling tower will operate continuously. The four smaller ESWS cooling towers are each designed for an air flow rate of 1.1 million acfm and 19,075 gallons per minute relying on water generated by the Desalination Plant. Only two ESWS units are required to be in service during normal operating conditions; the other two are available as backup units.

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

6.5.1 Federal and State Regulations

EPA has established National Ambient Air Quality Standards (NAAQS) for carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), particulate matter less than 10 microns (PM_{10}), particulate matter less than 2.5 microns ($PM_{2.5}$), and ozone (O_3). These ambient standards have been adopted by Maryland (COMAR 26.11.02). Federal and state regulations require the permitting of new and modified sources of air pollution and set limits on the emissions from certain source operations to provide for attainment and maintenance of the NAAQS.

New or modified sources of air emissions must file a permit application for authorization to construct with the State of Maryland prior to initiating construction. Under Maryland law, the PSC is the permitting authority for new and modified electric generating facilities. The MDE and the PPRP are responsible for reviewing the air portion of the CPCN application. The PSC holds public and adjudicatory hearings and, upon issuance, the CPCN constitutes authorization to construct. The PSC incorporates appropriate conditions as part of the CPCN, which may limit emissions, restrict operating practices, and require testing, monitoring, recordkeeping, and reporting. The requirements in a construction permit provide the basis for adopting or modifying a Part 70 operating permit. Under the federal Clean Air Act, these requirements are enforceable by MDE and EPA.

The specific requirements that must be addressed to obtain a construction permit depend on the air quality status for the geographic area where the source will be located, the source category, and the magnitude of emissions or potential-to-emit (PTE) qualifying a source as a minor or major source of emissions. The air quality status is based on monitoring data, and whether the area's air quality is equal to or better than the NAAQS for each criteria pollutant. Calvert County has been designated an area with air quality that is in attainment with the NAAQS for CO, SO_2, NO_2, PM_{10}, and $PM_{2.5}$. For ozone, however, Calvert County is designated as part of the Northeast Ozone Transport Region and, therefore, is considered nonattainment for O_3. Volatile organic compound (VOC) and nitrogen oxide (NO_x) emissions, precursors to ozone formation in the atmosphere, are regulated based on the ozone non-attainment designation.

The type of air permit that is needed also depends on the magnitude of air emission increases proposed by an applicant. More stringent permitting requirements apply to major sources than to minor sources. Because there are existing sources of air pollution at the facility that support Units 1 and 2, any increases in air emissions would be considered a modification to an existing source. Specific trigger levels have been established which define whether such increases in air emissions would be considered major in and of themselves (applicable if the existing facility is considered an existing minor source) or a major modification (applicable if the existing facility is considered an existing major source). The definition of major and minor source depends on the

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pollutant and the present air quality levels in the area and is different for nonattainment areas than for attainment areas.

In areas designated as attainment, EPA and Maryland regulations consider a source to be major for Prevention of Significant Deterioration (PSD) purposes if it has a potential to emit a regulated pollutant of 250 tons per year (tpy). However, there is an exception to this rule for certain industrial processes that are within twenty-eight specially listed source categories, for which the PSD major source threshold is 100 tpy. CCNPP Units 1 and 2 contain auxiliary steam boilers, which fall within one of the listed categories. No other emission units fall within the listed categories. In addition, the auxiliary boilers planned for CCNPP Unit 3 are electric (not fuel-fired).

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

Other toxic air pollutants are also subject to regulation. The toxic pollutants from Unit 3 are largely due to the chemicals used in the cooling water to prevent biological build-up and scaling of the pumps, spray heads, pipes, etc. For a list of 189 designated hazardous air pollutants (HAPs), EPA has established by source category National Emission Standard for Hazardous Air Pollutants (NESHAPs) that apply to major sources of HAPs. Maryland also regulates sources of "toxic air pollutants" (TAPs) and requires the application of best available control technology (T-BACT) to sources with TAP emissions exceeding thresholds calculated for each substance as a function of threshold-limit-values established by the American Council of Governmental and Industrial Hygienists (ACGIH) (COMAR 26.11.15). The proposed cooling towers for Unit 3 do not contribute significant quantities of HAPs or TAPs; however, the substances emitted from Unit 3 cooling towers must be included in the state air permitting analysis. Fuel burning equipment is exempt from the Maryland air toxics regulation (COMAR 26.11.15.03).

In the discussion provided below, the Co-Applicants have included a more detailed analysis of the best available control technology (BACT) and an air quality impact analysis for the sources of air pollution expected during the future operation of CCNPP Unit 3.

6.5.1.1 New Source Permits and Compliance with the NAAQS and PSD Increments

While the Co-Applicants have submitted a CPCN application for a new facility in accordance with the Maryland Public Utility Companies law, for the purposes of the PSD program the project will be analyzed as being an addition to an existing source of air emissions -- CCNPP Units 1 and 2. While the existing CCNPP Units 1 and 2 and the proposed Unit 3 will be owned and operated by separate entities, for PSD purposes they have been analyzed as a single source because they are on contiguous property and may be deemed to be under common control or ownership of a common corporate parent, Constellation Energy Group, Inc.

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The sources of air emission associated with CCNPP Units 1 and 2 consist of two auxiliary boilers with a combined heat input rate of 328 MMBTU/hr that are used to provide steam when both reactors are simultaneously shut down and seven emergency diesel generators that are used in the event that both reactors are down and outside power cannot be obtained from the grid. Generally, the emergency equipment is tested and run on a scheduled basis to assure compliance with NRC safety and reliability requirements.

CCNPP Units 1 and 2 are considered a major source of emissions under Maryland's Part 70/Title V operating permit program. This designation is based on the potential to emit particulate matter, NO_x, carbon monoxide, and sulfur dioxide. The maximum emissions assume full-time operation of the steam boilers and emergency diesel generators. With those assumptions, the PTE of PM/PM_{10} is 164 tpy, of NO_x is 1,917 tpy, of carbon monoxide is 486 tpy and of sulfur dioxide is 1,925 tpy as shown in Table 6.5-1. Actual emissions from CCNPP Units 1 and 2 have been consistently lower, as shown for example, by the average data for 2005 and 2006. These actual emissions primarily represent periods when the emergency equipment is being tested to assure readiness in case backup power is needed. Over the past 30+ years of operation, there has been virtually no need to operate any of the emergency equipment other than for maintenance testing. For the purposes of this CPCN application, however, it is assumed that CCNPP Units 1 and 2 are an existing major source for the purpose of PSD applicability, because potential emissions for one or more PSD-regulated pollutants exceed 250 tons per year.

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

	Particulate Matter (PM/PM_{10})	Nitrogen Oxides (NO_x)	Carbon Monoxide (CO)	Volatile Organic Compounds (VOCs)	Sulfur Dioxide (SO_2)
Maximum Calculated Emissions for Units 1 and 2	**164**	**1,917**	**486**	**46**	**1,925**
Average Actual Emissions for Units 1 and 2 (Based on 2005 & 2006)	**2.5**	**10.5**	**2.8**	**0.3**	**0.1**

In terms of triggering PSD permitting requirements, the applicable thresholds are the PSD major modification significant emission increase tonnage levels contained in the federal PSD regulations (40 CFR 52.21(b)(23)(i)). As shown in Table 6.5-2, the project triggers PSD review for PM/PM_{10}, with total annual emission increases for Unit 3 of 311.0 tpy for PM and 249.4 tpy for PM_{10}. Emission increases for other PSD-regulated criteria pollutants are below PSD significant increase thresholds.

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Table 6.5-2 Potential Emission Estimates for Unit 3

Source	Maximum Expected Emissions During Plant Operation (tpy)					
	PM	PM_{10}	NO_x	CO	VOC	SO_2
CWS Cooling Tower (1 tower)	306.3	245.0	0.0	0.0	0.0	0.0
ESWS Cooling Towers (4 towers)	3.1	2.9	0.0	0.0	0.0	0.0
Diesel Generators (6 units)	1.6	1.6	22.8	29.0	3.8	1.3
Total	311.0	249.5	22.8	29.0	3.8	1.3

The new backup power generators for Unit 3 will be small sources of NO_x and VOC and will qualify for permitting as a minor modification under the nonattainment New Source Review provisions of Maryland's permitting regulations as the PTE of NO_x and VOC is estimated at less than 25 tpy. Accordingly, the Co-Applicants will be seeking authorization consistent with the federal PSD requirements and will be filing a separate PSD Report for the Proposed Unit 3 at Calvert Cliffs Nuclear Power Plant ("PSD Report"), which is incorporated into this application by reference. The following is an overview of the key points in the PSD Report.

6.5.1.2 Applicable Emission Standards

In accordance with the PSD regulations, Best Available Control Technology (BACT) must be applied to all sources at Unit 3 that emit PM/PM_{10}. Co-Applicants discuss below the options considered in selecting the mist elimination system for the CWS cooling tower, the largest source of PM and PM_{10} emissions. Subsequently, we review the applicable emission regulations for all sources.

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

Figure 6.5-1 Rev. 1 is a schematic of the CWS cooling tower and shows the amounts of water that are needed to reject heat from the steam turbines. The maximum expected annual concentration ever anticipated of the inlet water is 17,500 ppm of TDS. The TDS level in the tower circulating water will be higher based on the operating "cycles of concentration." Some of these solids will be discharged into the air because the solid material will be dissolved in the tiny water droplets emitted from the tower. The tiny water droplets are formed because of the mechanical energy used to spray water within the cooling tower which increases the surface area of the water used to reject heat through evaporation. Evaporated water is a gas (H_2O), like the water associated with the humidity in the air, and does not contain any particles. Some droplets

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do not evaporate completely and are discharged through the top of the tower and contain dissolved particles. After a droplet leaves the tower, the water evaporates leaving the particle. This is the source of the particulate emission that must be considered in order to maintain air quality standards.

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

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

There are many factors that are used in assessing the technical feasibility of high efficiency drift eliminators. Table 6.5-3 clearly illustrates that the efficiency being contemplated by the Co-Applicants is practical and is within the range that other regulators have deemed to be the BACT for those sources.

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

Facility	Date Issued	Circulating Water Flow (gpm)	*Drift Eliminator* Efficiency (%)
Entergy Louisiana LLC Little Gypsy Generating Plant	11/10/2007	5,000	0.001
Basin Electric Power Cooperative Dry Fork Station	10/15/2007	N.A.	0.005
Great River Energy Spiritwood Station	09/14/2007	N.A	0.0005
Western Greenbrier Cogeneration LLC Western Greenbrier	04/26/2006	55,000	0.0005
Cleco Power Rodemacher Brownfield Unit 3	02/23/2006	301,874	0.0005
Diamond Wanapa I LP Wanapa Energy Center	08/08/2005	3,532	0.0005
Public Service Company of Colorado Comanche Station	07/05/2005	140,650	0.0005
Newmont Nevada Energy Corporation	05/05/2005	N.A	0.0005

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Facility	Date Issued	Circulating Water Flow (gpm)	Drift Eliminator Efficiency (%)
TS Power Plant			
Omaha Public Power District Nebraska City Station	03/09/2005	N.A	0.0005
Darrington Energy LLC Darrington Energy Center	02/11/2005	N.A	0.001
BP West Coast Products LLC BP Cherry Point Cogeneration Project	01/11/2005	N.A	0.001
Dome Valley Energy Partners Wellton Mohawk Generating Station	12/01/2004	170,000	0.0005
Wisconsin Public Service WTS Weston Plant	11/19/2004	N.A	0.002
Entergy New Orleans, Inc. Michoud Electric Generating Plant	10/12/2004	1,728	0.005 (Design 0.001)
Longview Power LLC Maidsville Station	03/02/2004	5,000	0.001
Allegheny Energy Supply LLC La Paz Generating Facility	09/04/2003	141,400 173,870	0.0005 0.0005
MidAmerican Energy Company MidAmerican Energy Plant	06/17/2003	349,400	0.001
Wallula Generation LLC Wallula Generation Power Plant	01/03/2003	N.A	0.0005
Interstate Power & Light Emery Generating Station	12/20/2002	140,000	0.005
Genova Arkansas I LLC Genova Arkansas I	08/27/2002	190,000	0.001
Mustang Power Mustang Energy Project	02/12/2002	N.A	0.004
Mustang Power Horseshoe Energy Project	02/12/2002	111,438	0.001
Venture Lease Company LLC Plaquemine Cogeneration Facility	12/26/2001	N.A	0.01
Source: EPA RACT/BACT/LAER Clearinghouse at http://cfpub.epa.gov/rblc/htm/bl02.cfm.			

The Co-Applicants have contacted several vendors who have provided information on their cooling towers and the drift eliminators that could be used. These vendors have provided information that support a drift eliminator efficiency of 0.0005%. One vendor has further indicated that any further enhancement in the drift elimination would need to be field tested before it could be specified as applicable to this unit.

The 0.0005% removal efficiency is equal to the other cooling towers that have recently been permitted through the PSD process. The Co-Applicants have concluded that the chevron drift eliminator represents the best available control technology for the CWS cooling tower. Emissions will be controlled to the design specification of 0.0005% of the recirculated water rate.

Maryland Cooling Tower Regulations

The cooling towers are a source of particulate emissions and must comply with a total particulate matter (PM) limitation in COMAR 26.11.06.03B(a). Sources installed in Calvert County, which has an "Area V" designation, must meet a PM emission limit of 0.05 grains per dry standard

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cubic foot of exhaust air. This regulation was developed for industrial sources of dust. Although it could technically apply to cooling towers, the Unit 3 cooling tower, even without a drift eliminator (uncontrolled), would never approach the allowed level of emissions under this regulation, i.e., the allowable PM emissions are 24,604 lb/hr and the expected PM in all water droplets would be only 69.9 lb/hr.

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

Estimated Emissions

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

To estimate the PTE for PM_{10}, worst-case assumptions were used for the cooling tower drift rate, total dissolved solids concentration, and the fraction of drift that is PM_{10}. The same parameters were used for the CWS and the ESWS towers, although the total dissolved solids in the ESWS units would be considerably lower based on use of desalinated water. All units were assumed to operate 8,760 hours per year to estimate PTE. The expected operation of the four ESWS units is the equivalent of two of the four units operating year round. Thus, the PTE estimates are overestimates of actual emissions.

The basis for the emission estimates for the cooling towers is presented in Table 6.5-4. The estimated PM emissions from the cooling towers (309.4 tpy) are most of the total PM emissions (311.0 tpy) from Unit 3. Emission estimates from the cooling towers for PM_{10} and $PM_{2.5}$ are also provided in Table 6.5-4.

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

Parameter	Units	CWS	ESWS
Number of Units		1	2 (a)
Design Air Flow Rate	acfm	119,600,000 (b)	1,100,000 each
Design Water Flow Rate	gpm	777,560	19,075 each
Water Source		Chesapeake Bay	Desalination Plant
MDE PM Emission Limit	Grains/dscf	0.05	0.05
	Equivalent allowable lbs/hour	27,604	539 each
Cooling Tower Drift Rate	% of Circulating Water	0.0005	0.005
Total Dissolved Solids in Makeup Water	ppm	17,500	372
Cycles of Concentration Ratio (Tower/Makeup Water)	Ratio	2.0	2.0
Estimated Worst-Case PM Emission Rate	Tons/year	306.3	3.1
Drift Fraction as PM_{10}	Fraction	0.80	0.93
Drift Fraction as $PM_{2.5}$	Fraction	0.13	0.16
Estimated PM_{10} Emissions (PTE)	Lbs/hour	55.9	0.66
	Lbs/day	1,342.5	15.9
	Tons/year	245.0	2.9
	Tons/year All Units	247.9	
Estimated $PM_{2.5}$ Emissions (PTE)	Lbs/hour	9.1	0.11
	Lbs/day	218.1	2.7
	Tons/year	39.8	0.5
	Tons/year All Units	40.3	

(a) Only 2 ESWS cooling towers operate; 2 others are available as backup units.
(b) This acfm corresponds to simultaneous operation of the wet and dry sections of the cooling tower. The modeled conservatively low flow rate corresponds to 66,454,900 acfm from the wet section and no operation of the dry section.

Cooling Tower Toxic Air Pollutant Analysis

Maryland regulates air emissions of individual chemical substances that qualify as "toxic air pollutants" or TAPs (COMAR 26.11.15 and .16). Class I TAPs are known or potential carcinogens specifically identified in COMAR 26.11.16.06. Class II TAPs include all other chemical compounds that have other potential acute or chronic health effects including those regulated by OSHA. The TAP regulations include provisions for exempting sources with low levels of TAP emissions and, for non-exempt sources, calculating screening values for mass

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emission rates (i.e., lbs per hour or lbs per year) and ambient air concentration levels (i.e., ground-level air quality in micrograms per cubic meter). If screening levels are exceeded, then more extensive analysis is required. If estimated emission rates and ambient concentrations are less than screening values, no further ambient impact analysis of TAPs is required. Sources subject to preconstruction review for TAP emissions must demonstrate the use of best available control technology for TAPs (T-BACT). Cooling towers are the only source of TAP emissions subject to review. Fuel burning equipment is exempt (COMAR 26.11.15.03B(2)(a)).

The cooling towers are the only source of TAP emissions. Tower operation requires the use of chemical additives to the cooling water to prevent biological growth and scale build-up that would reduce heat transfer and cooling tower performance. Table 6.4-2 lists chemical additives and the estimated quantities of each of the materials expected to be used in the operation of CCNPP Unit 3, including those used by the cooling towers. Based upon the material usage rates for the ESWS cooling towers, the TAP emission rates for the ESWS cooling towers are estimated to be two orders of magnitude lower than those from the CWS cooling tower. Therefore, only TAP emissions from the CWS cooling tower were modeled.

These chemicals will be added to the cooling tower makeup water or to the blowdown at varying concentration levels. The cooling tower drift will contain the chemicals added to the makeup water at the same concentrations they were added, and as such, will be a source of TAP emissions. Chemicals added only to the blowdown (i.e., sodium bisulfite) will not be released in the drift. The chemicals released with the drift that are subject to TAP review include sodium hypochlorite, sodium hydroxide, a constituent in the dispersant (1-hydroxy-1,1-diphosphonoethane or HEDP), and a constituent in the antifoaming agent (petroleum distillates). Appendix A to the PSD Report includes the completed MDE Form 5A required for the review of TAPs.

The emission rate for each TAP was estimated based on the drift loss rate, the same approach used for the PM and PM_{10} emission estimates from the cooling towers. The concentration in the drift was estimated based on the expected chemical use rate in the makeup water. The screening values were taken from MDE's April 2007 Screening Level Listing, with the exception of HEDP. The HEDP screening value was calculated based on animal study data from the MSDS for the dispersant as provided for by COMAR 26.11.16.03A(2)(a)(vi).

The ambient air quality impact for each TAP was determined using the maximum air quality impact estimated for PM_{10}, adjusted by the ratio of TAP to PM_{10} emission rates. One-hour and 8-hour concentrations were calculated using the EPA-approved AERMOD model with 5 years of on-site meteorological data used as input (see Section 6.5.2 for more details about the modeling procedures). The screening values, estimated emission rates, and estimated ambient impacts for the CWS cooling tower are shown in Table 6.5-5. It is clear that the estimated ambient impacts are well below the screening levels, so no additional analysis is needed for the TAP assessment.

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Table 6.5-5 TAP Analysis Results

Chemical	MDE Screening Value ($\mu g/m^3$)	Estimated Emission Rate (lbs/hour)	Estimated Maximum Ambient Impact ($\mu g/m^3$)
Sodium Hypochlorite	81.2 8-hour	0.000651	0.000038 8-hour
Sodium Hydroxide	20 1-hour	0.000163	0.000038 1-hour
HEDP	82 8-hour (based on Oral Rat LD50 > 2,000 mg/kg)	0.000219	0.000013 8-hour
Petroleum Distillate	170 8-hour	0.000069	0.0000041 8-hour

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

Backup Power Generators

The new backup power generators, at a minimum, will be in compliance with the federal Standards of Performance for New Stationary Compression Ignition Internal Combustion Engines (40 CFR Part 60, Subpart IIII). At a minimum, they will meet the requirements for emergency engines with greater than 30 liters per cylinder displacement (40 CFR 60.4205(d)) and for emergency engines with greater than 10, but less than 30 liters per cylinder displacement (40 CFR 60.4202(c)). These emission rates will be achieved through application of available diesel control technology at time of purchase. The sulfur content of diesel fuel that will be consumed by the generators will be no more than the 500 ppm allowed for diesel engines with greater than 30 liter cylinders (40 CFR 60.4207(a) and 80.510(a)).

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

Maryland regulations prohibit the burning of distillate fuel oil with greater than 0.3 percent sulfur with an Area V designation including Calvert County (COMAR 26.11.09.07). The federal requirement for burning fuel with 500 ppm (0.05%) sulfur or less at time of installation will be considerably more stringent than the state requirement. Fuel-burning equipment consuming distillate oil are exempt from Maryland particulate limitations for fuel combustion because of low levels of particulate emissions (COMAR 26.11.09.06.A(3)(c)). Maryland regulations do not

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include a limit on NO_x emissions for fuel-equipment that operates less than 500 hours with a capacity factor of less than 15%. Thus, there are no applicable emission regulations for NO_x for the Unit 3 generators.

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

Aside from maintenance testing, the EDGs and SBOs operate during certain non-normal conditions associated with loss of offsite power (LOOP) in order to provide power to the plant for a safe shutdown and continued operation of the ESWS cooling towers as needed. In the event of a LOOP event, Unit 3 will be designed to operate in an "island mode," where the main generator continues to provide power to the plant loads without interruption and without need for backup power. In most cases, the offsite power would be restored within 24 hours, and plant operations would return to normal. However, in the very unlikely event that the "island mode" fails or the LOOP event lasts more than 24 hours (the maximum duration of the island mode operational state), then the EDGs would be activated to assist in a safe plant shutdown. During a LOOP event for which "island power" is also lost, the CWS cooling tower would not be operated, but the backup power would be used to power the ESWS cooling towers.

The expected operation of the EDGs in this case would be that all four available EDGs would start. The power requirements of the plant in this case are two EDGs at 70% of maximum rated capacity. Note that due to NRC requirements, the EDGs are oversized and would not operate at their maximum design capacity during events requiring backup power. After the first hour of operation, two of the four EDGs would be shut down after the proper operation of at least 2 EDGs is assured. Although the EDG output would likely be reduced over the next 23 hours due to the shedding of loads and the gradual plant shutdown, a conservative assumption is that these two EDGs will operate at 70% load for the rest of the day.

In the event that none of the EDGs are operational in the case of a LOOP event and a failure of the island mode (a "beyond design basis" event), then power will be supplied by the two SBO generators that serve as a backup to the EDGs. The NRC license design documentation for station blackout coping indicates that the SBO generators would be required to operate for no more than 8 hours, during which the plant will be safely shut down if offsite power is not restored.

The extent of backup power operations is expected to be very limited, especially for the SBOs, which may never operate in backup power mode. In fact, over the past 30 years, the EDGs (for existing Units 1 and 2) have operated in backup power mode only once, for up to 8 hours. The same expectation of a very rare need for the backup power is expected to continue into the future, especially with the unique island mode capability for Unit 3. However, the extent of operations allocated to the group of Unit 3 EDGs and SBOs for each year, for purposes of

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computing the PTE, is expected to far exceed that which is required to cover the needed commitment for maintenance testing and providing backup power.

To estimate PTE for these units, the maximum worst-case hours of operation at 100% load was assumed, 600 hours for all four EDGs combined and 200 hours for both SBOs combined. The generator emission rates and PTE estimates are presented on Table 6.5-6. The estimated PTE for NO_x is 22.8 tons/year, less than the 25 tons per year major source threshold that applies in Calvert County. The estimates for PM_{10} emissions from the generators, which must be considered with the cooling tower emissions, are insignificant, as shown in the table.

Table 6.5-6 Potential Emission Estimates[a] for 4 EDG and 2 SBO Generators

	Emergency Diesel Generators (EDGs)	Station Black Out Generators (SBOs)
Engine Size, kWe	10,130	5,000
Maximum Annual Hours of Operation over all Generators, 100% load equivalent	600	200
Carbon Monoxide (CO) Lbs/hour per generator Tons/year per generator	 78.2 5.9	 55.1 2.8
Nitrogen Oxides (NO_x) Lbs/hour per generator Tons/year per generator	 35.7 2.7	 121.3 6.1
Particulate Matter (PM_{10}) Lbs/hour per generator Tons/year per generator	 3.1 0.23	 5.1 0.25
$PM_{2.5}$ – (97% PM_{10}, EPA) Lbs/hour per generator Tons/year per generator	 3.0 0.23	 4.9 0.25
Sulfur Oxides (SO_x) Lbs/hour per generator Tons/year per generator	 4.4 0.33	 0.07 0.0035
Volatile Organic Compounds (VOC) Lbs/hour per generator Tons/year per generator	 8.7 0.65	 12.1 0.61

(a) The ton per year estimates for the total generator emissions in Table 6-5.2 are equivalent to the sum of four times the ton per year estimates for the EDGs plus two times the ton per year estimates for the SBOs in this table.

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6.5.1.3 Summary of Compliance with Air Regulations

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

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

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

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

- Federal Emission Standards for Hazardous Air Pollutants – CCNPP Units 1 and 2 are not a major source of HAP emissions and, therefore, is not subject to the MACT standard for cooling towers or the MACT standard for reciprocating internal combustion engines.

- Prevention of Significant Deterioration – Because the PTE for the existing Units 1 and 2 categorizes the current plant as a major source, the addition of Unit 3 qualifies as a major modification to an existing major source subject to the PSD regulations. Because only PM and PM_{10} are emitted in significant quantities, Unit 3 is subject to PSD only for those pollutants. In accordance with the PSD regulations, an air quality modeling analysis was conducted to demonstrate that CCNPP Unit 3 in combination with nearby background sources will comply with the NAAQS and PSD increments for PM_{10}. In conformance with current EPA and state policy, the Co-Applicants will use compliance with the NAAQS for PM_{10} as a surrogate for compliance with the $PM_{2.5}$ NAAQS to meet PSD modeling requirements.

- State Construction Permit – Because CO, NO_x, and SO_2 are not emitted in significant quantities, Unit 3 is subject to state permitting requirements for these pollutants. In accordance with Maryland requirements, an air quality modeling analysis was conducted to demonstrate that CCNPP Unit 3 will have an insignificant impact for CO, NO_x, and SO_2 and thus will not affect current compliance with the corresponding NAAQS and PSD increments.

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- Nonattainment New Source Review – Because the PTE for NO_x and VOC from the sources at Unit 3 is less than 25 tpy, Unit 3 qualifies as a minor source not subject to the requirements of Nonattainment New Source Review.

6.5.2 Air Quality Impacts from Plant Operations

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

Although the emissions of 249.4 tons per year of PM_{10} are significantly greater than emissions during construction, most of the emissions that will occur during operation of CCNPP Unit 3 will be from the cooling tower. Furthermore, the emissions will feature an elevated release which will result in effective dispersion of the emissions. For these reasons, impacts at ground level are expected to be very low.

Short-term normal operations involve the following short-term criteria pollutant emission sources:

- Case 1: no backup equipment testing – the CWS cooling tower and two ESWS cooling towers - particulate emissions only

- Case 2: Case 1 emissions plus one EDG engine operating at 100% load for a full 24 hours

- Case 3: Case 1 emissions plus one SBO engine operating for 12 hours.

The CWS cooling tower design is based on a design air flow rate of 66.5 million acfm from the "wet" section and a supplemental air flow rate from the "dry" section for plume abatement. Depending on ambient conditions, the dry section fans can be operated from 0% to 100% of full fan speed. For this modeling analysis, we conservatively modeled the CWS cooling tower with a constant sustained operation of zero flow through the dry section. We obtained information from SPX on the exhaust temperature of the CWS cooling tower as a function of temperature and relative humidity. Due to the highly variable nature of this input value to AERMOD, we created hourly input parameters for the exit temperature based upon the SPX information.

Since the extended maintenance testing for Cases 2 and 3 occur only once every 2 years for each EDG (Case 2) or once every 18 months for Case 3, the expected number of days a year involved in Case 2 and Case 3 testing emissions is from 3 to 6.

Worst-case operational scenarios requiring backup power involve the following short-term criteria pollutant emission sources:

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- Case 1: two ESWS cooling tower particulate emissions plus 4 EDGs operating at 70% load for 1 hour and 2 EDGs operating at 70% load for an additional 23 hours.

- Case 2: two ESWS cooling tower particulate emissions plus 2 SBOs operating for 8 hours. This case is very unlikely because it is triggered only if the EDGs are all inoperable.

Although the need for backup power is extremely rare and would not be expected to last more than a day at most per operational event, the annual hours of operation for the backup power requirement conservatively allow for 216 EDG hours and 120 SBO hours for backup power at 100% load.

The modeling results are listed in separate tables for each pollutant modeled for the emission scenarios mentioned above. Results are discussed below by pollutant.

Sulfur Dioxide (SO_2) Modeling Results

Table 6.5-7 provides a summary of modeling results for SO_2 emissions. The results indicate that all emission scenarios lead to impacts below the EPA's Significant Impact Levels (SILs), so there is no need for additional modeling of SO_2 impacts.

Table 6.5-7 Modeling Results for SO_2 Impacts from Unit 3 Emissions

Pollutant	Averaging Period	Operating Scenario	Modeled Sources	2001-2005 Max Modeled Concentration	Class II Significant Impact Level	NAAQS
				($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
SO_2	3-hr	Normal Operations Case 2	1 EDG Testing at 100% Load	9.84	25	1,300
	3-hr	Normal Operations Case 3	1 SBO	0.19	25	1,300
	3-hr	Backup Power Operations Case 1	4 EDGs at 70% Load for 1 hr & 2 EDGs at 70% Load for rest of period	15.45	25	1,300
	3-hr	Backup Power Operations Case 2	2 SBOs for 8 hrs	0.37	5	365
	24-hr	Normal Operations Case 2	1 EDG Testing at 100% Load for 24 hrs	3.38	5	365
	24-hr	Normal Operations Case 3	1 SBO Testing for 12 hrs	0.05	5	365
	24-hr	Backup Power Operations Case 1	4 EDGs at 70% Load for 1 hr & 2 EDGs at 70% Load for rest of period	3.86	5	365
	24-hr	Backup Power Operations Case 2	2 SBOs for 8 hrs	0.10	5	365
	Annual	Annual hours of operation	4 EDGs & 2 SBOs	0.03	1	80

Carbon Monoxide (CO) Modeling Results

Table 6.5-8 provides a summary of modeling results for CO emissions. The results indicate that all emission scenarios lead to insignificant impacts, so there is no need for additional CO modeling.

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Table 6.5-8 Modeling Results for CO Impacts from Unit 3 Emissions

Pollutant	Averaging Period	Operating Scenario	Modeled Sources	2001-2005 Max Modeled Concentration	Class II Significant Impact Level	NAAQS
				($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
CO	1-hr	Normal Operations Case 2	1 EDG at Testing 100% Load	267.8	2,000	40,075
	1-hr	Normal Operations Case 3	1 SBO	287.3	2,000	40,075
	1-hr	Backup Power Operations Case 1	4 EDGs at 70% Load	665.5	2,000	40,075
	1-hr	Backup Power Operations Case 2	2 SBOs	574.5	2,000	40,075
	8-hr	Normal Operations Case 2	1 EDG Testing at 100% Load	112.8	500	10,305
	8-hr	Normal Operations Case 3	1 SBO	114.3	500	10,305
	8-hr	Backup Power Operations Case 1	4 EDGs at 70% Load for 1 hr & 2 EDGs at 70% Load for rest of period	140.7	500	10,305
	8-hr	Backup Power Operations Case 2	2 SBOs	228.5	500	10,305

Nitrogen Dioxide (NO_2) Modeling Results

Table 6.5-9 provides a summary of modeling results for NO_x emissions. Even with the assumption of 100% conversion of NO_x to NO_2. The results indicate that all emission scenarios lead to insignificant impacts, so there is no need for additional NO_2 modeling.

Table 6.5-9 Modeling Results for NO_2 Impacts from Unit 3 Emissions

Pollutant	Averaging Period	Operating Scenario	Modeled Sources	2001-2005 Max Modeled Concentration	Class II Significant Impact Level	NAAQS
				($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
NO_X	Annual	Annual hours of operation	4 EDGs & 2 SBOs	0.6	1	100

Particulate Matter Less than 10 Microns (PM_{10}) Modeling Results

Table 6.5-10 provides a summary of modeling results for PM_{10} emissions. The results indicate that annual impacts are insignificant, but short-term impacts can exceed the daily SIL of 5 $\mu g/m^3$ for only one case, which is the very unlikely backup power case 2 scenario, assuming a conservatively high PM emission rate for that class of diesel engines (a lower EPA standard takes effect in 2014). This modeled impact occurs at the plant fenceline (at the shoreline) and the modeling indicates an extent of the Significant Impact Area (SIA) of about 1.2 km from the CWS cooling tower. This result triggers a requirement to conduct a NAAQS and PSD increment compliance analysis that incorporates the impact of other sources.

For the NAAQS and PSD compliance analyses, ENSR modeled short-term PM_{10} emissions from CCNPP Units 1 and 2 as well as from nearby background sources. The PSD inventory included only those emergency generator units that were put into operation after the major source baseline date of January 6, 1975. An emission inventory of the PM_{10} emission sources throughout

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Virginia was recently provided by Mr. Michael Kiss of the Virginia Department of Environmental Protection for the Mirant Potomac Power Plant in Virginia. Mr. Kiss also provided an emission inventory for the District of Columbia (through Mr. Abraham Hagos of the Department of Health's Air Quality Division) and for Maryland (through Mr. Michael Woodman of MDE). ENSR considered all background sources within the SIA plus 50 kilometers as candidates for the cumulative modeling. ENSR applied a conservative low Q/D (tons per year emissions divided by distance of the source from CCNPP in km) rule of thumb of 0.3 was used (instead of the often used North Carolina rule of 20) to eliminate sources that would not have an impact on the cumulative modeling and to be consistent with Federal Land Manager guidance for PSD increment inventories. The sources eliminated were presumed not to have a significant concentration gradient near the project source, and their impact is accounted for in the conservatively high regional background concentration added to the total computed impact. The total short-term impacts were estimated by adding the highest, second-high impact of all sources modeled (resolved to a horizontal resolution of 100 m) to the background value. The resulting second highest PM_{10} daily value is about 123.2 $\mu g/m^3$, which is below the 150 $\mu g/m^3$ NAAQS. The results of the PM10 short-term PSD increment modeling resulted in the second highest PM_{10} concentration of 26.4 $\mu g/m^3$, which is below the PSD increment limit of 30 $\mu g/m^3$.

Table 6.5-10 Modeling Results for PM_{10} Impacts from Unit 3 Emissions

Averaging Period	Operating Scenario	Modeled Sources	2001-2005 Max Modeled Concentration	Class II Significant Impact Level	NAAQS
			($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
24-hr	Normal Operations Case 1	CWS & ESWS	1.1	5	150
24-hr	Normal Operations Case 2	CWS & ESWS & 1 EDG Testing at 100% Load	2.9	5	150
24-hr	Normal Operations Case 3	CWS & ESWS & 1 SBO Testing for 12 hrs	4.4	5	150
24-hr	Backup Power Operations Case 1	ESWS & 4 EDGs at 70% Load for 1 hr & 2 EDGs at 70% Load for rest of period	3.3	5	150
24-hr	Backup Power Operations Case 2	ESWS & 2 SBOs for 8 hrs	7.8	5	150
Annual	Annual hours of operation	CWS & ESWS & 4 EDGs & 2 SBOs	0.1	1	50

6.5.3 Application for Permit-to-Construct

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

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17. Addition of PSD Report for the Proposed Unit 3 at Calvert Cliffs Nuclear Power Plant to Appendix A, Environmental Reports, at Volume 6.

In the Technical Report, in the "Index to Appendix A: Environmental Reports," insert PSD Report for the Proposed Unit 3 at Calvert Cliffs Nuclear Power Plant at Volume 6, Tab 20.

Dated March 28th, 2008

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Exhibit 1

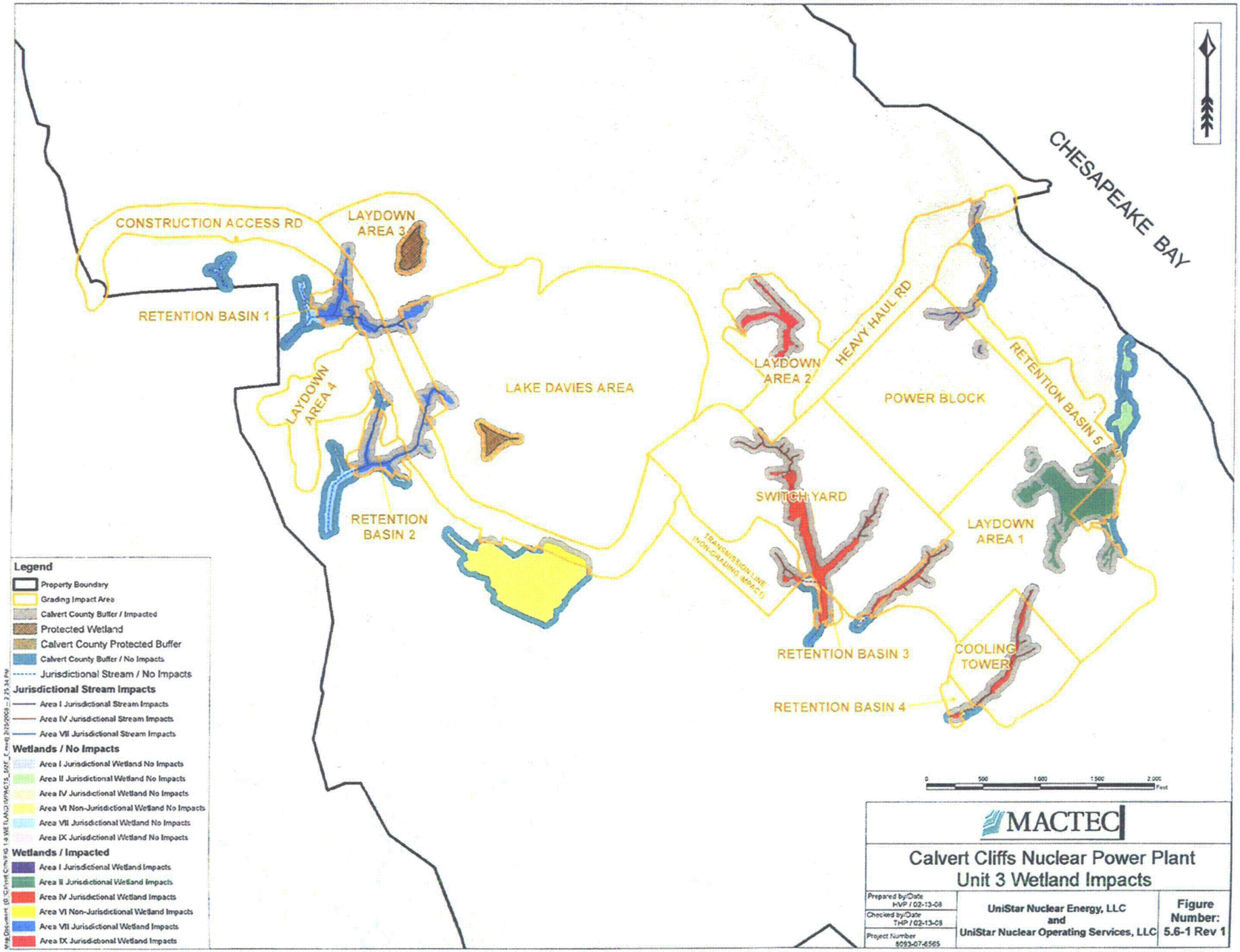
CHESAPEAKE BAY
CONSTRUCTION ACCESS RD
LAYDOWN AREA 3
RETENTION BASIN 1
LAYDOWN AREA 4
RETENTION BASIN 2
LAKE DAVIES AREA
LAYDOWN AREA 2
HEAVY HAUL RD
POWER BLOCK
RETENTION BASIN 5
SWITCH YARD
TRANSMISSION LINE (NON-GRADING IMPACT)
LAYDOWN AREA 1
RETENTION BASIN 3
COOLING TOWER
RETENTION BASIN 4
Legend
Property Boundary
Grading Impact Area
Calvert County Buffer / Impacted
Protected Wetland
Calvert County Protected Buffer
Calvert County Buffer / No Impacts
Jurisdictional Stream / No Impacts
Jurisdictional Stream Impacts
Area I Jurisdictional Stream Impacts
Area IV Jurisdictional Stream Impacts
Area VII Jurisdictional Stream Impacts
Wetlands / No Impacts
Area I Jurisdictional Wetland No Impacts
Area II Jurisdictional Wetland No Impacts
Area IV Jurisdictional Wetland No Impacts
Area VI Non-Jurisdictional Wetland No Impacts
Area VII Jurisdictional Wetland No Impacts
Area IX Jurisdictional Wetland No Impacts
Wetlands / Impacted
Area I Jurisdictional Wetland Impacts
Area II Jurisdictional Wetland Impacts
Area IV Jurisdictional Wetland Impacts
Area VI Non-Jurisdictional Wetland Impacts
Area VII Jurisdictional Wetland Impacts
Area IX Jurisdictional Wetland Impacts
0 500 1,000 1,500 2,000 Feet
MACTEC
Calvert Cliffs Nuclear Power Plant
Unit 3 Wetland Impacts
Prepared by/Date HVP / 02-13-08
Checked by/Date THP / 02-13-08
Project Number 6093-07-6565
UniStar Nuclear Energy, LLC and UniStar Nuclear Operating Services, LLC
Figure Number: 5.6-1 Rev 1

Exhibit 2

Table 5.6-4 Rev. 1 Nontidal Wetland and Nontidal Wetland Buffer Losses in Acres (Hectares) Construction of Proposed CCNPP Unit 3

Wetland Assessment Area	Permanent Grading Losses				Temporary Grading Losses				Permanent Non-Grading Losses (Forest Clearing for Transmission Line)				Total Losses	
	PFO	PEM	Open Water	Buffer	PFO	PEM	Open Water	Buffer	PFO	PEM	Open Water	Buffer	Wetland	Buffer
I- Total	0.03 (0.01)	-	-	2.71 (1.09)	-	-	-	-	-	-	-	-	0.03 (0.01)	2.71 (1.09)
I-Outside CBCA	0.02 (0.01)	-	-	0.78 (0.32)	-	-	-	-	-	-	-	-	0.02 (0.01)	0.78 (0.32)
I-Inside CBCA-IDA	-	-	-	1.06 (0.43)	-	-	-	-	-	-	-	-	-	1.06 (0.43)
I-Inside CBCA-RCA	0.01 (0.00)	-	-	0.87 (0.35)	-	-	-	-	-	-	-	-	0.01 (0.00)	0.87 (0.35)
II- Total	1.49 (0.60)	0.78 (0.32)	2.67 (1.08)	7.18 (2.91)	-	-	-	-	-	-	-	-	4.94 (2.00)	7.18 (2.91)
II-Outside CBCA	1.17 (0.47)	0.76 (0.31)	2.66 (1.08)	6.32 (2.56)	-	-	-	-	-	-	-	-	4.60 (1.86)	6.32 (2.56)
II-Inside CBCA-RCA	0.32 (0.13)	0.02 (0.01)	0.01 (0.00)	0.85 (0.35)	-	-	-	-	-	-	-	-	0.35 (0.14)	0.86 (0.35)
III-Total	No Impacts to Wetland Assessment Area III													
IV-Total	4.48 (1.81)	-	-	14.39 (5.82)	-	-	-	-	0.14 (0.06)	-	-	1.07 (0.43)	4.62 (1.87)	15.46 (6.26)
V-Total	No Impacts to Wetland Assessment Area V													
VI-Total	0.28 (0.11)	0.34 (0.14)	-	0.93 (0.38)	-	-	-	-	-	-	-	-	0.62 (0.25)	0.93 (0.38)
VII-Total	3.00 (1.21)	-	-	9.24 (3.74)	-	-	-	-	-	-	-	-	3.00 (1.21)	9.24 (3.74)
VIII-Total	No Impacts to Wetland Assessment Area VIII													
IX-Total	0.64 (0.24)	0.48 (0.19)	-	3.31 (1.34)	-	-	-	-	-	-	-	-	1.12 (0.45)	3.31 (1.34)
Total	9.92 (4.01)	1.60 (0.65)	2.67 (1.08)	37.76 (15.71)	-	-	-	-	0.14 (0.06)	-	-	1.07 (0.43)	14.33 (5.80)	38.82 (15.71)

Notes:

PFO: Palustrine Forested CBCA: Chesapeake Bay Critical Area RCA: Resource Conservation Area

PEM: Palustrine Emergent IDA: Intensively Developed Area

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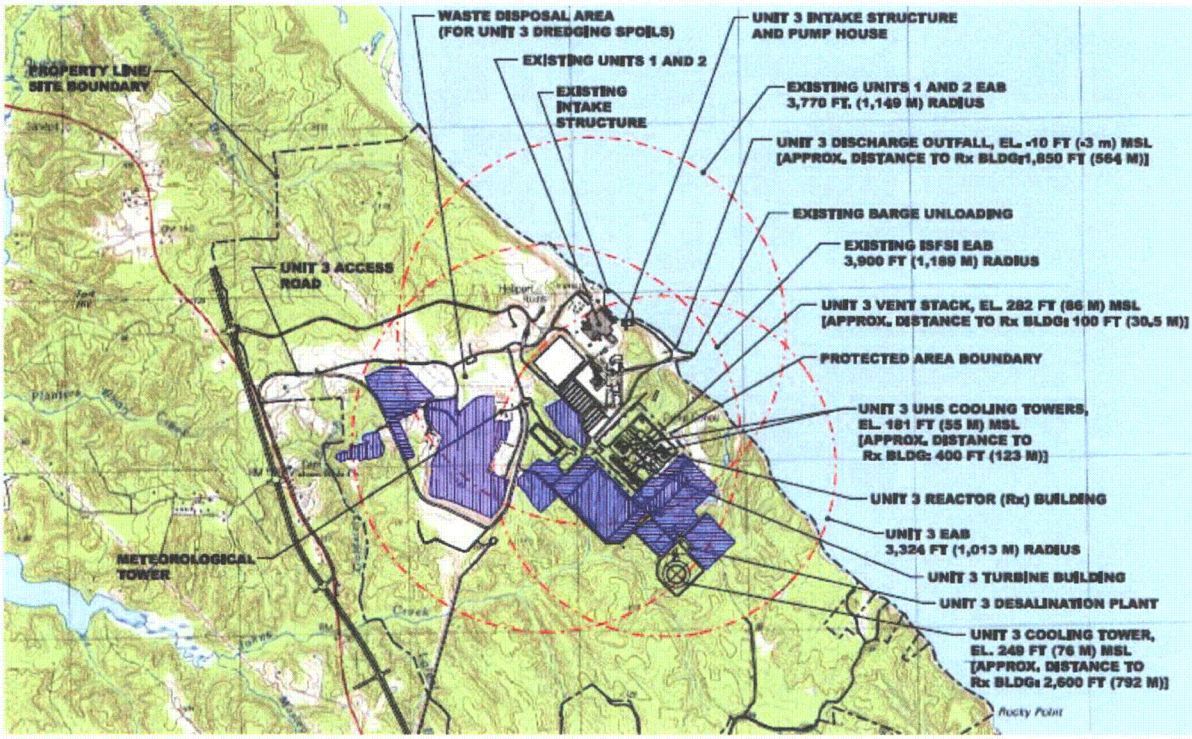
Exhibit 3

Prepared for:
UniStar Nuclear Energy, LLC and
UniStar Nuclear Operating Services, LLC



PSD Report for the Proposed Unit 3 at Calvert Cliffs Nuclear Power Plant

ENSR Corporation
March 2008
Document No.: 04189-025-0016

ENSR | AECOM

Prepared for:
UniStar Nuclear Energy, LLC and
UniStar Nuclear Operating Services, LLC

PSD Report for the Proposed Unit 3 at Calvert Cliffs Nuclear Power Plant

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Robert J. Paine

Ian Thomson

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March 2008
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1.0 Introduction

UniStar Nuclear Energy, LLC (UNE) and UniStar Nuclear Operating Services, LLC (UNO) (Co-Applicants) are proposing to construct and operate a new nuclear power unit on the existing Calvert Cliffs Nuclear Power Plant (CCNPP) site. The new unit will be designated as CCNPP Unit 3, and will have a gross electric generation capacity of about 1,710 megawatts.

The CCNPP campus, currently owned by Calvert Cliffs Nuclear Power Plant, Inc., consists of 2,070 acres near Lusby, Calvert County, Maryland, on the west bank of the Chesapeake Bay, approximately halfway between the mouth of the bay and its headwaters at the Susquehanna River. Figure 1-1 shows the CCNPP location. The site is approximately 40 miles southeast of Washington, D.C. and 7.5 miles north of Solomons Island, Maryland.

The CCNPP property contains two existing pressurized water reactors designated as CCNPP Units 1 and 2. The proposed CCNPP Unit 3 will be located approximately 600 meters south of the existing nuclear power plant within the present CCNPP site. In contrast to CCNPP Units 1 and 2, which use a once-through cooling system, CCNPP Unit 3 will have a closed-loop cooling system and utilize a large mechanical draft cooling tower to provide the necessary cooling for the steam leaving the turbine generator.

On November 13, 2007, the Co-Applicants filed an Application for a Certificate of Public Convenience and Necessity (CPCN) from the Public Service Commission[1] for Unit 3. The addition of Unit 3 will represent a major modification as defined under the PSD regulations. The project will be subject to PSD review for PM/PM_{10} only. The emissions of other PSD-regulated pollutants associated with the project are below the applicable emissions thresholds that would trigger PSD permitting requirements. The emissions of the nonattainment criteria pollutants associated with the project (NOx and VOC emissions) are below the applicable significant emissions thresholds that would trigger nonattainment New Source Review permitting requirements.

1.1 Purpose of PSD Report

This report provides the technical analyses and supporting data for the application for the PSD permit to construct CCNPP Unit 3. The document addresses the following items:

- A control technology evaluation demonstrating that emissions will be controlled to a level that constitutes Best Available Control Technology (BACT) for the PSD-applicable pollutants ($PM_{10}/PM_{2.5}$);
- An air dispersion modeling analysis demonstrating that the impact of emissions will be in compliance with the National Ambient Air Quality Standards (NAAQS) and PSD increments for PM_{10} and $PM_{2.5}$. This analysis was completed in accordance with the U.S. EPA Guideline on Air Quality Models as codified at 40 CFR Part 51, Appendix W. In conformance with current EPA and state policy, the Co-Applicants used PM_{10} as a surrogate for compliance with the PSD requirements for $PM_{2.5}$.
- An additional impacts analysis for the PSD-applicable pollutants. This analysis addresses the impacts of air emissions from the project on soils, vegetation and visibility, and from associated growth.

[1] The Power Plant Research Program of the Maryland Department of Natural Resources (PPRP) reviews the air permit application portion of the CPCN application in consultation with the Maryland Department of the Environment's Air and Radiation Management Administration (MDE-ARMA) within the context of the CPCN proceeding.

- An analysis of potential impacts on PSD Class I areas. A request for a waiver of PSD Class I modeling requirements due to the project's low level of air emissions and the large distance to the nearest PSD Class I areas was granted by the Federal Land Managers representing the National Park Service, the Fish & Wildlife Service, and the Forest Service.

Other materials previously provided to PPRP/MDE in support of the PSD permit application and included by reference are as follows:

- An air quality modeling protocol that has been provided to PPRP and MDE, as well as to the Federal Land Managers, that describes the modeling approach for both local and long-range project ambient impacts;
- Formal responses to PPRP/MDE comments on the modeling protocol; and
- A formal request to allow the use of available, representative ambient monitoring data for PM_{10} in lieu of requiring UniStar to conduct pre-application ambient monitoring for PM_{10}. This request also covers the case (shown later in this report) for which modeled impacts of PM_{10} are below the de minimis levels for pre-construction monitoring.

The Co-Applicants are amending the CPCN Technical Report[2] to reflect the PSD analysis.

1.2 Contents of the PSD Report

This report document consists of nine sections, including this section, and 4 appendices. Section 2 presents a description of the project and associated air emission sources. A summary of the air emissions from Unit 3 sources is presented in Section 3 along with details on how the source equipment will be operated. The BACT analysis is presented in Section 4. The dispersion modeling approach is discussed in Section 5 and results of the impact assessment for Unit 3 emissions are presented in Section 6. Section 7 discusses the PSD Class I analysis. The results of the multi-source cumulative modeling analysis for PM_{10} are presented in Section 8. Additional impact issues are discussed in Section 9. References are provided in Section 10. Appendix A provides the completed MDE permit application forms for the air emission sources associated with Unit 3. Appendix B presents agency correspondence related to the granting of the requested waiver from a PSD Class I impact analysis. Appendix C contains information on background sources used in the cumulative modeling analysis. A computer modeling archive is being provided separately.

[2] "Technical Report in Support of Application of UniStar Nuclear Energy, LLC and UniStar Nuclear Operating Services, LLC for Certificate of Public Convenience and Necessity Before the Maryland Public Service Commission for Authorization to Construct Unit 3 at Calvert Cliffs Nuclear Power Plant and Associated Transmission Lines".

Figure 1-1: CCNPP and Unit 3 Location

2.0 Project Description

This section describes several aspects of the proposed Unit 3 new generating station that are relevant for the air quality modeling analysis. A more detailed description of Unit 3 can be found in the Technical Report to the CPCN application.

2.1 New Generating Station Location and Layout

The proposed CCNPP Unit 3 will be located at the existing CCNPP site. Figure 2-1 shows the proposed site layout relative to the existing facility. Figure 2-2 shows Unit 3 sources and buildings overlaid on an aerial photo. The CCNPP property contains two existing pressurized water reactors designated as CCNPP Units 1 and 2. The proposed CCNPP Unit 3 will be located approximately 600 meters south of the existing nuclear power plant.

The CCNPP Unit 3 Reactor Building and Turbine Building will be side by side, with the Reactor Building oriented toward the east. The Reactor Building will be surrounded by the Fuel Pool Building, four Safeguard Buildings, two Emergency Diesel Generator Buildings, the Reactor Auxiliary Building, the Radioactive Waste Processing Building, and the Access Building (collectively, the Power Block).

The CCNPP Unit 3 Reactor Building is planned as an upright cylindrical concrete structure, capped with a spherical dome. The Reactor Building will be 186 ft in diameter and will have an overall height of 204 ft above the plant grade elevation of approximately 85 ft.

In contrast to CCNPP Units 1 and 2, which use a once-through cooling system, CCNPP Unit 3 will have a closed-loop cooling system. The CCNPP Unit 3 Circulating Water Supply System (CWS) Cooling Tower will be a round concrete structure with an overall diameter of about 528 ft and approximate height of 164 ft. The CCNPP Unit 3 Ultimate Heat Sink function will be provided by four mechanical forced draft Essential Service Water System (ESWS) cooling towers situated above storage basin pools. Each of the four pools will be approximately 0.19 acres in size and will not occupy significant land area beyond the tower footprint. The pools will normally be supplied with makeup water from the nonsafety-related CCNPP Unit 3 Desalination Plant. The ESWS cooling towers will be about 106 ft tall. The Desalination Plant footprint will be approximately 65 ft by 165 ft and situated adjacent to and east of the CWS Cooling Tower.

2.2 Project Emission Sources

The air emissions sources associated with the operation of Unit 3 include the cooling tower for the Cooling Water System (CWS), four Essential Service Water System (ESWS) cooling towers, and four emergency diesel generators (EDGs), backed up by two station black-out (SBO) generators.

The CWS cooling tower, which will be equipped with high efficiency drift eliminators, will be a source of particulate matter as a result of cooling tower "drift," i.e., the release of impurities, largely salt, in the water entrained in the air stream and carried out in the cooling tower plume. This is the largest source of PM/PM_{10} emissions at Unit 3.

The ESWS cooling towers will rely on water treated at the on-site desalinization plant, and only two ESWS cooling towers are expected to be in service during normal operating conditions.

The diesel generators will be available to provide backup power, and consist of four 10,130 kWe emergency diesel generators and two 5,000 kWe diesel Station Black Out Generators as a backup to the emergency diesel generators. The diesel generators will emit pollutants from fuel combustion when operating.

Figure 2-1 CCNPP Unit 3 Layout Relative to the Existing Facility

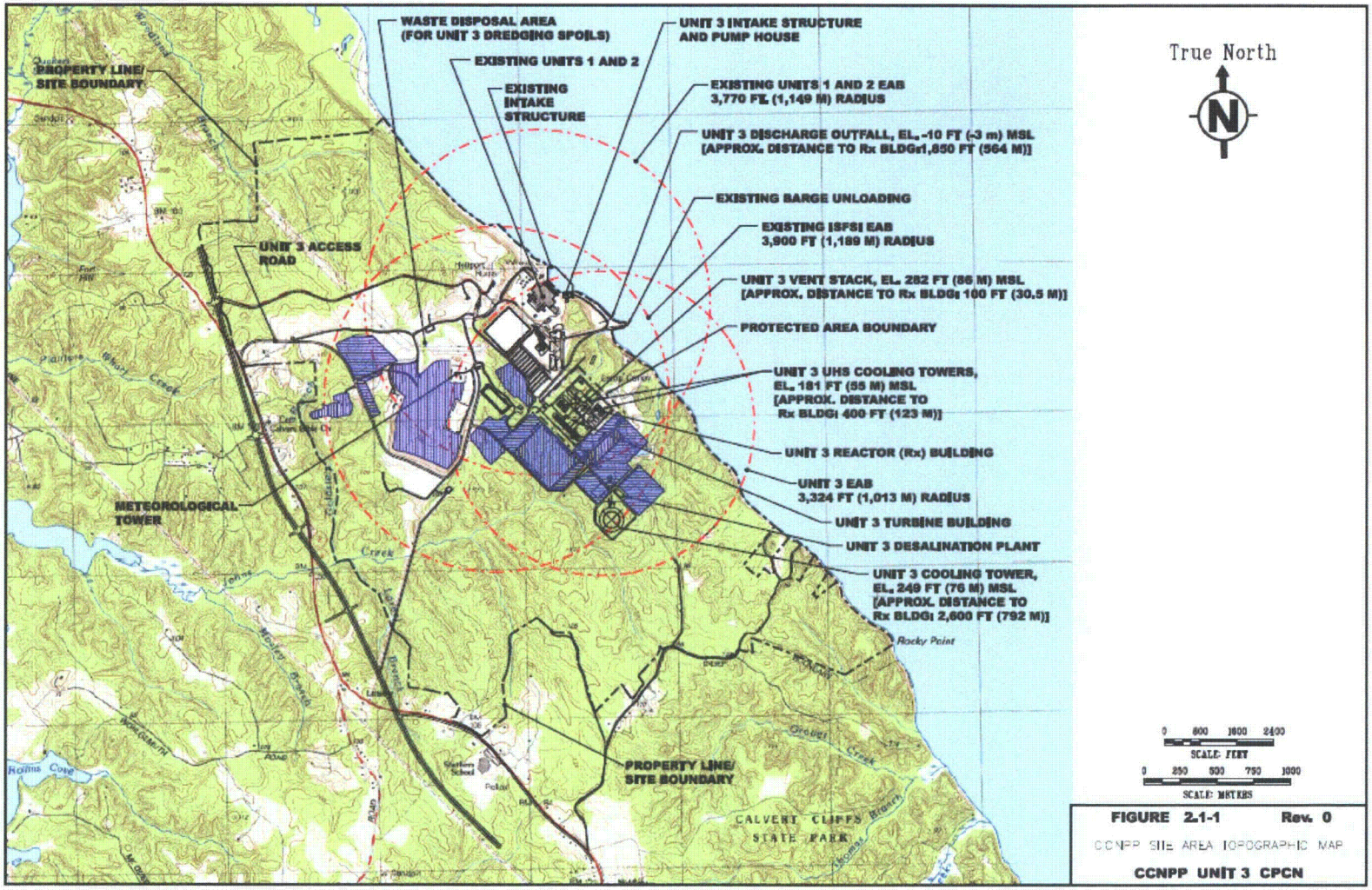
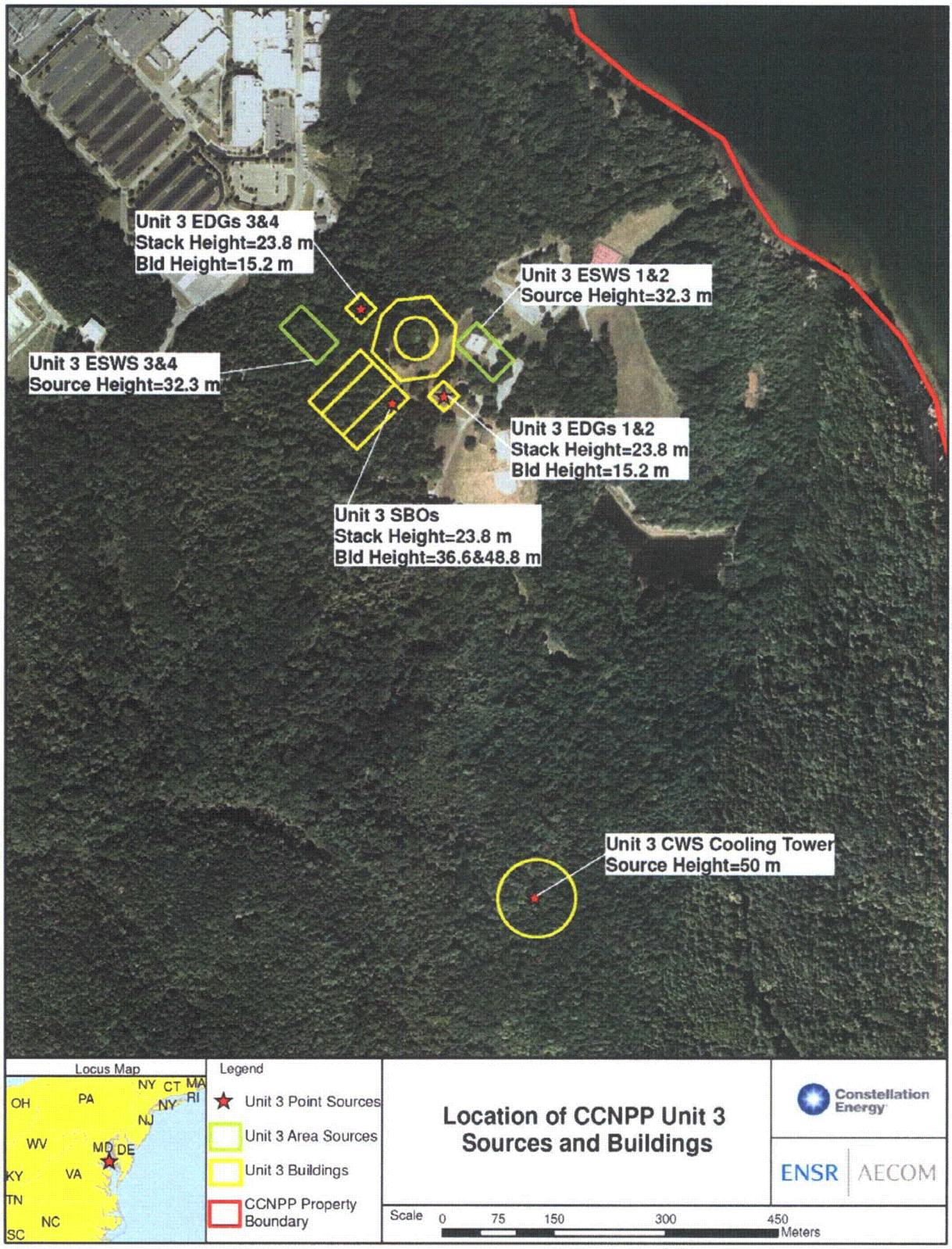


Figure 2-2 Location of CCNPP Unit 3 Sources and Buildings



3.0 Emissions Summary

3.1 Description of Emission Scenarios to Model

The CWS cooling tower design is based on a design air flow rate of 66.5 million acfm from the "wet" section and a supplemental air flow rate from the "dry" section for visible plume abatement. The CWS will have a water circulation rate of about 778,000 gallons per minute, with makeup water drawn from the Chesapeake Bay to offset evaporation, drift, and blowdown. The four smaller ESWS cooling towers are each designed for an air flow rate of 1.1 million acfm and about 19,075 gallons per minute, relying on water generated by the Desalination Plant. Only two ESWS units will typically be in service during normal operating conditions. Emergency power will be provided by four 10,130 kWe EDGs and two 5,000 kWe diesel SBOs as a backup to the EDGs.

3.1.1 Normal Operations

During normal plant operations, criteria pollutant emissions will be generated by the CWS cooling tower, which will operate continuously, and two of the ESWS cooling towers (although four will be available, only two will be needed for normal operations, and the other two units serve as standby units). The drift eliminator efficiency for the CWS cooling tower is currently specified by SPX Cooling Technologies as 0.0005%. The PM emissions, 69.93 lb/hr, are based upon a worst-case assumption of 17,500 ppm total dissolved solids (TDS) in the makeup water taken from the Chesapeake Bay (i.e., salt level in the Bay water), the tower operating at 2 cycles of concentration (COC) of cooling water circulation, and the drift eliminator having a 0.0005% efficiency. The COC is an indicator of the extent of water recirculation and equates to the ratio of the TDS level in the operating tower to the intake concentration.

Additional particulate emissions will be generated during normal operations by two ESWS cooling towers. The particulate emissions from these cooling towers are much lower than those of the CWS cooling tower because of the smaller size of the towers and the availability of desalinated makeup water for these cooling towers.

As the CPCN Technical Report indicates, it is estimated that each EDG will be tested approximately 4 hours every month, plus an additional 24 to 48 hours once every 2 years. The highest short-term emissions associated with this testing program would be 100% load conditions for a 24-hour period. The EDG testing would involve only one generator during a given testing period. It is estimated that each SBO diesel generator will be tested approximately 4 hours every quarter, plus an additional 12 hours every year for maintenance activities. The SBO diesels will also be tested for an extended period of about 12 hours every 18 months. The highest short-term emissions for routine SBO maintenance testing will involve a 12-hour period for one SBO generator. The SBO testing will be done at different periods for each SBO engine, and not concurrently with the EDG testing.

To summarize, short-term normal operations involve the following short-term criteria pollutant emission sources:

- Case 1: no backup equipment testing – the CWS cooling tower and two ESWS cooling tower - particulate emissions only,
- Case 2: Case 1 emissions plus one EDG engine operating at 100% load for a full 24 hours for testing and maintenance,
- Case 3: Case 1 emissions plus one SBO engine operating for 12 hours for testing and maintenance.

For modeling purposes, the very conservative approach was taken where the CWS cooling tower was assumed to operate in the wet mode only for these three normal operation cases, i.e., no supplemental flow

from through the dry section. This mode results in the lowest possible flow rate, resulting in the lowest momentum and buoyancy rise.

Because the extended maintenance testing for Cases 2 and 3 occurs only once every 2 years for each EDG (Case 2) or once every 18 months for Case 3, the expected number of days a year involved in routine testing operations of an EDG or an SBO for as many as 12 to 24 hours is as follows:

- normal operations Case 2: up to 2-4 days per year total for routine testing of all the EDGs, and
- normal operations Case 3: up to 2 days per year total for routine testing of the SBOs.

3.1.2 Operations Requiring Backup Power

Aside from maintenance testing, the EDGs and SBOs operate during certain non-normal conditions associated with loss of offsite power (LOOP) in order to provide power to the plant for a safe shutdown and continued operation of the cooling towers as needed. In the event of a LOOP event, Unit 3 will be designed to operate in an "island mode", where the main generator continues to provide power to the plant loads without interruption. In most cases, the offsite power would be restored within 24 hours, and plant operations would return to normal. In this situation, the EDGs and SBOs would not be started up.

However, in the very unlikely event that the "island mode" somehow fails or the LOOP event lasts more than 24 hours (the maximum duration of the island mode operational state), then the EDGs would be activated to assist in a safe plant shutdown. The expected operation of the EDGs in this case would be that all four available EDGs would start. The maximum load requirement of the plant in this case is two EDGs at 70% of maximum rated capacity. Note that due to NRC requirements, the EDGs are oversized and would not operate at their maximum design capacity during events requiring backup power. After the first hour of operation, two of the four EDGs would be shut down after the proper operation of at least 2 EDGs is assured. Although the EDG output would likely be reduced over the next 23 hours due to the shedding of loads and the gradual plant shutdown, a conservative assumption will be to analyze the air quality impact from the operation of these two EDGs at 70% load for the rest of the day. During a LOOP event for which "island power" is also lost, the CWS cooling tower would not be operated, but the backup power would be used to power the ESWS cooling towers.

In the extremely rare event that none of the EDGs are operational in the case of a LOOP event that lasts more than 24 hours, leading to a failure or cessation of the island mode (a "beyond design basis" event), then power will be supplied by the two SBO generators that serve as a backup to the backup power that would normally be supplied by the EDGs. The NRC license design documentation for station blackout coping indicates that the SBO generators would be required to operate for no more than 8 hours, during which the plant will be safely shut down if offsite power is not restored.

To summarize, worst-case operational scenarios requiring backup power involve the following short-term criteria pollutant emission sources:

- Case 1: two ESWS cooling tower particulate emissions plus 4 EDGs operating at 70% load for 1 hour and 2 EDGs operating at 70% load for an additional 23 hours
- Case 2: two ESWS cooling tower particulate emissions plus 2 SBOs operating for 8 hours.

The extent of backup power operations is expected to be very limited, especially for Case 2, which will probably never happen, but which the plant is equipped to handle. In fact, over the past 30 years, the EDGs (for existing Units 1 and 2) have operated in backup power mode only once, for up to 8 hours. The same expectation of a very rare need for the backup power is expected to continue into the future, especially with the unique island mode capability for Unit 3. However, the extent of operations allocated to the group of Unit 3 EDGs and SBOs for each year (noted in the next subsection) for purposes of computing the potential to emit is expected to far exceed that which is required to cover the needed commitment for maintenance testing and providing backup power.

3.1.3 Annual Average Emissions

Emissions for annual average modeling assume the following sources:

- the CWS cooling tower operating continuously,
- two ESWS cooling towers operating continuously,
- EDG operations that are the equivalent of 600 combined engine-hours at 100% load, and
- SBO operations that are the equivalent of 200 combined engine-hours at 100% load.

3.2 Emissions Data for Modeling Input

3.2.1 Characterizing Exhaust Characteristics of the CWS Cooling Tower

The CWS hybrid cooling tower is not a traditional emission source for a number of reasons:

- its exhaust stream is comprised of a substantial amount of water vapor and some water droplets;
- the source has a large diameter;
- the air flow rate is variable, depending upon whether the "dry section" of this tower is in operation; and
- the excess temperature of the emissions above ambient is a function of ambient temperature as well as the humidity.

For simplicity in the modeling approach, a number of conservative assumptions have been made. The source was modeled as a point source with a prescribed exit temperature and exit velocity. The buoyancy of this source is underestimated (and, thus, the modeled ground-level impacts are overestimated) with the use of standard modeling approaches that do not consider the thermodynamic effects of a moist plume due to the following reasons:

- the heat of condensation for water vapor that condenses out is not considered,
- extra plume rise due to a very large diameter plume that takes more time to be diluted is not considered, and
- the substantial water vapor in the plume makes the effective molecular weight of the plume smaller (water is 18 vs. 29 for dry air).

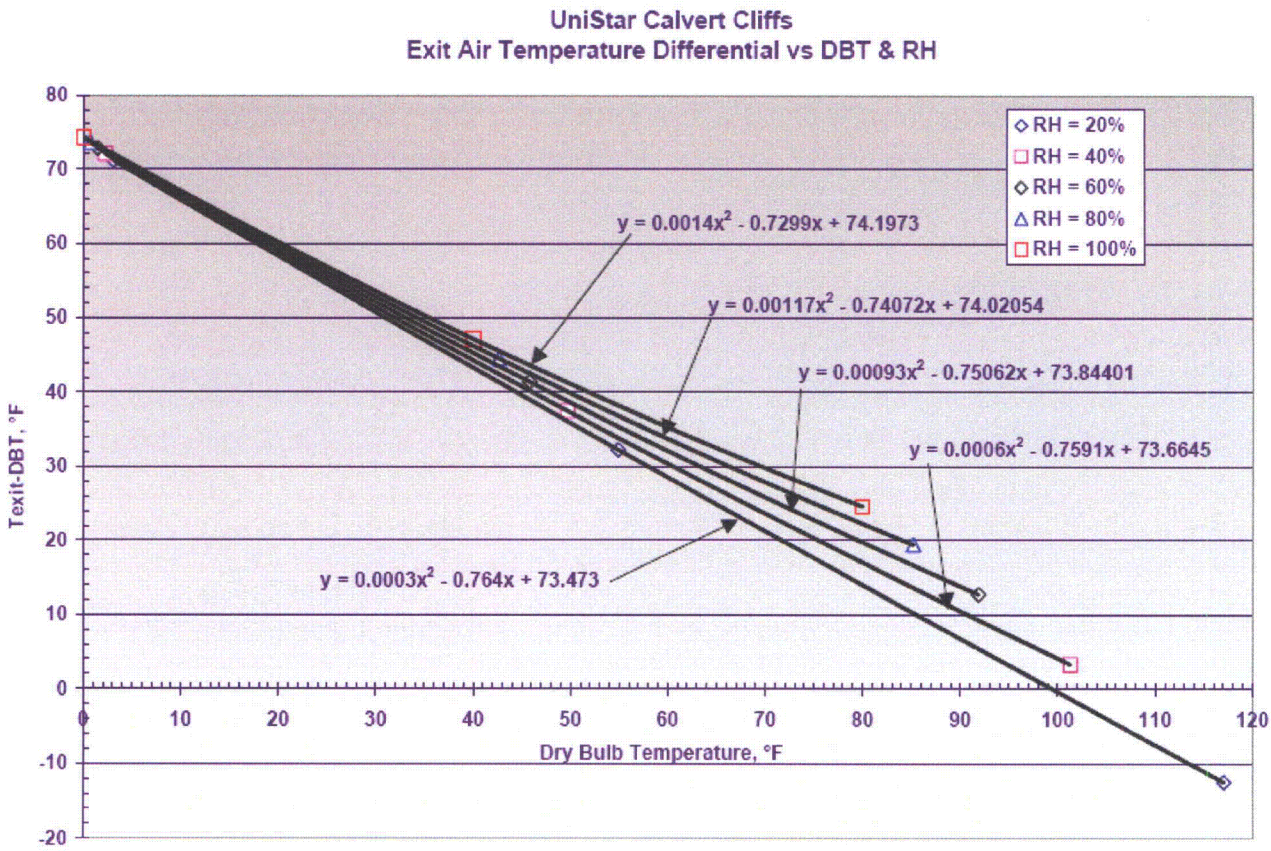
The "wet section" of the cooling tower has an air flow of about 66.5 million acfm, while the "dry section" used for visible plume abatement, if necessary, can range in operation between 0 and about 52.1 million acfm for air flow. For maximum flexibility for operating the CWS cooling tower, the most conservative modeling option is to assume no operation of the dry section at all to minimize the calculated plume rise.

For the operation of the wet section only, the exhaust temperature can vary widely as a function of ambient temperature and humidity (for high ambient temperatures), as shown in Figure 3-1 (provided by SPX). It is evident that the exhaust temperature is always at least about 73°F, but at higher ambient temperatures, it exceeds the ambient temperature by a value that is strongly dependent upon the relative humidity. Therefore, it is prudent to consider the computation of hourly exit exhaust temperatures based upon the curves presented in Figure 3-1. This is easily done with the use of the 10-m on-site temperature data in conjunction with representative relative humidity data.

The on-site tower does not have measurements of relative humidity since the Nuclear Regulatory Commission (NRC) monitoring guidelines only require atmospheric moisture measurements for nuclear plants utilizing cooling towers. Existing Units 1 and 2 utilize an open-cycle once-through cooling system. The nearest source

of humidity data is the Patuxent River Naval Air Station, which is located south of the CCNPP on a peninsula in St. Mary's County. However, for the years 2001-2005, the Patuxent Naval Air Station has data capture below 90% for multiple years, with some individual months below 70% data capture. Accordingly, use of this database would not meet PSD requirements for use in modeling due to the available meteorological data capture. A much more complete and comprehensive database is available from the Reagan International Airport (DCA). A direct comparison of the measurements between the two meteorological stations during periods when both are reporting indicates, as one would expect due to its proximity to the coast, that the average relative humidity is slightly higher (about 6% higher) at Patuxent River Naval Air Station. The use of lower relative humidity data from DCA will lead to conservatively lower exit temperatures for the CWS cooling tower with the use of the curves shown in Figure 3-1.

Figure 3-1 Dependence of CWS Cooling Tower Excess Temperature Relative to Ambient Conditions



The emissions from the ESWS cooling towers are much lower than that of the CWS cooling tower. A very conservative modeling treatment for this set of cooling towers was to treat them as nonbuoyant area sources with a release height corresponding to the top of the cooling towers.

Exhaust characteristics associated with the EDGs and SBOs are specified for representative engines in each category. For modeling purposes, the SBO engine emissions are conservatively high, based upon existing emission rules for marine diesels with power output greater than 3,700 KWh, with engine cylinder displacement less than 30 liters. An EPA rule issued on March 14, 2008 stipulates much lower (Tier 4) PM and NO_x emissions for this class of engines, but not until 2014. The SBO engines will need to be procured before that time, and may not be available at the time of procurement with the Tier 4 emissions.

The estimated short-term and annual pollutant emissions associated with the operation of Unit 3 cooling towers are listed in Table 3-1 and estimated emissions associated with the EDGs and SBOs are listed in Table 3-2. Stack parameters used in the modeling are provided in Table 3-3.

Table 3-1 Unit 3 Maximum Hourly and Annual Emissions from Cooling Towers (a)

Parameter	Units	CWS	ESWS (b)	Total
No. of Units	None	1	2	NA
Air Flow Rate	cfm	66,454,900(c)	1,100,000	NA
Water Flow Rate	gpm	777,560	19,075	NA
Water Density	lb/gal	8.57 (d)	8.34	NA
Drift Rate	% CW	0.0005	0.005	NA
TDS	ppmw	17,500	372	NA
Cycles of	Ratio	2	2	NA
PM_{10}	Fraction	0.80 (e)	0.93 (e)	NA
$PM_{2.5}$	Fraction	0.13 (e)	0.16 (e)	NA
Hourly Emissions				
PM	lb/hr	69.93	0.71	70.64
PM_{10}	lb/hr	55.94	0.66	56.60
$PM_{2.5}$	lb/hr	9.09	0.11	9.20
Annual Emissions				
PM	tpy	306.28	3.11	309.39
PM_{10}	tpy	245.03	2.89	247.92
$PM_{2.5}$	tpy	39.82	0.50	40.31

(a) Based on information provided in "Technical Report in Support of the Application of UNISTAR Nuclear Energy, LLC and UNISTAR Nuclear Operating Services, LLC for Certification of Public Convenience and Necessity Before the Maryland Public Service Commission for Authorization to Construct Unit 3 at Calvert Cliffs Nuclear Power Plant and Associated Transmission Lines."

(b) Only 2 ESWS cooling towers operate at any 24-hour period.

(c) Assumes a conservatively low air flow due to operation of the wet section only.

(d) Density of brackish recirculating water with a maximum TDS concentration of 35,000 ppm.

(e) Based on methodology for computing the particle size distribution for PM/PM_{10} emissions from cooling towers published in "Calculating Realistic PM_{10} Emissions from Cooling Towers", Reisman, J. and G. Frisbie, *Environmental Progress*, Vol. 21, No. 2, July 2002.

Table 3-2 Unit 3 Maximum Hourly and Annual Emissions from Engines Providing Backup Power (a)

Parameter	Units	EDG 1	EDG 2	EDG 3	EDG 4	SBO 1	SBO 2	4 EDGs	Total
Engine Size (100% capacity)	kWe	10,130	10,130	10,130	10,130	5,000	5,000	N.A.	N.A.
Sulfur Content	ppmw	500	500	500	500	15	15	N.A.	N.A.
Hourly Firing Rate	gph	630	630	630	630	332	332	N.A.	N.A.
Hours of Operation	hr/yr	150	150	150	150	100	100	N.A.	N.A.
Annual Firing Rate	gpy	94500	94500	94500	94500	33200	33200	N.A.	N.A.
Emission Factors									
NO_x	g/kW-hr	1.60 (b)	1.60 (b)	1.60 (b)	1.60 (b)	11.00 (c)	11.00 (c)	N.A.	N.A.
SO2	g/kW-hr	0.20 (d)	0.20 (d)	0.20 (d)	0.20 (d)	0.0064 (d)	0.0064 (d)	N.A.	N.A.
CO	g/kW-hr	3.50 (e)	3.50 (e)	3.50 (e)	3.50 (e)	5.00 (c)	5.00 (c)	N.A.	N.A.
PM	g/kW-hr	0.15 (b)	0.15 (b)	0.15 (b)	0.15 (b)	0.50 (c)	0.50 (c)	N.A.	N.A.
PM10	g/kW-hr	0.15 (f)	0.15 (f)	0.15 (f)	0.15 (f)	0.50 (f)	0.50 (f)	N.A.	N.A.
$PM_{2.5}$	g/kW-hr	0.15 (f)	0.15 (f)	0.15 (f)	0.15 (f)	0.49 (f)	0.49 (f)	N.A.	N.A.
VOC	g/kW-hr	0.39 (g)	0.39 (g)	0.39 (g)	0.39 (g)	1.10 (c)	1.10 (c)	N.A.	N.A.
Hourly Emissions at 100% load									
NO_x	lb/hr	35.73	35.73	35.73	35.73	121.25	121.25	142.93	385.43
SO2	lb/hr	4.44	4.44	4.44	4.44	0.070	0.070	17.77	17.91
CO	lb/hr	78.16	78.16	78.16	78.16	55.11	55.11	312.65	422.88
PM	lb/hr	3.35	3.35	3.35	3.35	5.51	5.51	13.40	24.42
PM10	lb/hr	3.35	3.35	3.35	3.35	5.51	5.51	13.40	24.42
$PM_{2.5}$	lb/hr	3.25	3.25	3.25	3.25	5.35	5.35	13.00	23.70
VOC	lb/hr	8.71	8.71	8.71	8.71	12.13	12.13	34.84	59.09
Annual Emissions									
NO_x	tpy	2.68	2.68	2.68	2.68	6.06	6.06	10.72	22.84
SO2	tpy	0.33	0.33	0.33	0.33	0.004	0.004	1.33	1.34
CO	tpy	5.86	5.86	5.86	5.86	2.76	2.76	23.45	28.96
PM	tpy	0.25	0.25	0.25	0.25	0.28	0.28	1.00	1.56
PM10	tpy	0.25	0.25	0.25	0.25	0.28	0.28	1.00	1.56
$PM_{2.5}$	tpy	0.24	0.24	0.24	0.24	0.27	0.27	0.96	1.50
VOC	tpy	0.65	0.65	0.65	0.65	0.61	0.61	2.61	3.83

(a) Based on information provided in "Technical Report in Support of the Application of UNISTAR Nuclear Energy, LLC and UNISTAR Nuclear Operating Services, LLC for Certification of Public Convenience and Necessity Before the Maryland Public Service Commission for Authorization to Construct Unit 3 at Calvert Cliffs Nuclear Power Plant and Associated Transmission Lines."
(b) Based on compliance with 40 CFR 60.4205(d).
(c) Based on compliance with 40 CFR 60.4205(b) limits for CO, 100% of combined NO_x and NMHC limit for NO_x, and 10% of combined limit for NO_x and NMHC for VOC.
(d) Based on material balance and maximum fuel oil sulfur content.
(e) Based on emission standards for large nonroad diesel engines ignition in 40 CFR 80.112.
(f) Based on particle size distribution cited in technical support documents for the NSPS for diesel engines promulgated in July 2006_____.
(g) Based on emission factor cited in AP-42, Section 3.4, Table 3.4-1.

Table 3-3 Unit 3 Stack Parameters

Pollutant	Units	EDG 1	EDG 1&2	EDG 3&4	SBO 1	SBO 1&2	CWS	ESWS 1&2	ESWS 3&4
UTM-X (Zone 18)	m	374,491	374,491	374,380	374,422	374,422	374,614	374,557	374,321
UTM-Y (Zone 18)	m	4,254,011	4,254,011	4,254,129	4,254,002	4,254,002	4,253,336	4,254,032	4,254,055
Stack Height	m	23.8	23.8	23.8	23.8	23.8	50	32.3	32.3
Base Elevation	m	25	25	25	25.9	25.9	30	24.4	24.4
Temperature	K	767.6	767.6 (708.6) *	767.6 (708.6) *	767.6	767.6	varies hourly	-	-
Velocity	m/s	58.7	58.7 (47.5) *	58.7 (47.5) *	56.8	56.8	3.62	-	-
Diameter	m	0.89	0.89	0.89	0.64	0.64	105	-	-
Area	m^2	-	-	-	-	-	-	2,800	2,800

* Value in parenthesis corresponds to 70% load operations.

4.0 Control Technology Evaluation

4.1 Technical Approach

The Co-Applicants propose to design, construct, and operate Unit 3 at the Calvert Cliffs Nuclear Power Plant. According to 40 CFR 52.1(j)(2), the Co-Applicants must apply Best Available Control Technology (BACT) for those pollutants that are emitted in significant quantities, that is, particulate matter (PM) and particulate matter with a mean diameter of less than 10 microns (PM_{10}). Unit 3 will include the following stationary sources: the CWS cooling tower, the ESWS cooling tower, four emergency diesel generators (EDGs), and two station black out generators (SBOs). This section documents the BACT analysis for PM_{10} and $PM_{2.5}$ (hereinafter referred collectively to as PM) emitted from these sources associated with Unit 3.

4.1.1 Top-Down BACT Analysis

Maryland requires that applicants for a PSD pre-construction permit conduct a BACT analysis for all regulated pollutants emitted in significant quantities from major stationary sources to demonstrate compliance with the control technology requirements of the PSD regulations under 40 CFR 52.21(j)(2). According to 40 CFR 52.21(b)(12), BACT is defined as:

> *"an emissions limitation based on the maximum degree of reduction for each pollutant subject to regulation under Act which would be emitted from any proposed major stationary source or major modification which the Administrator, on a case-by-case basis, taking into account energy, environmental, and economic impacts and other costs, determines is achievable for such source or modification through application of production processes or available methods, systems, and techniques, including fuel cleaning or treatment or innovative fuel combustion techniques for control of such pollutant."*

In no event must application of BACT result in emissions of any pollutant that would exceed those allowed by any applicable requirements in the Maryland regulations under COMAR 26.11, New Source Performance Standards under 40 CFR Part 60, or National Emission Standards for Hazardous Air Pollutants under 40 CFR Parts 61 and 63.

Maryland requires a 'top down' approach to the BACT analysis. The process begins with the identification of the alternative control technologies available for the source category based upon a review of: (1) those technologies required by previous BACT determinations made by the EPA or the various state agencies; and (2) those technologies applied in practice to the same category or a similar source category by means of technology transfer. The available control technologies are then evaluated to determine whether they are technically feasible for the given application. Those control technologies found to be technically infeasible are eliminated from further consideration, while the remaining control technologies are ranked by their performance levels, from the highest to the lowest performance level. The technically feasible control technologies are then evaluated on the basis of the associated economic, energy and environmental impacts. If an alternative technology, starting with the highest performance level, is eliminated based on any of these criteria, the control technology with the next highest performance level is evaluated until a control technology qualifies as BACT. Historically, the cost effectiveness of alternative control technologies in reducing air pollutant emissions is the principle criteria used by Maryland in their determinations of BACT.

According to EPA guidance, BACT may be achieved by one or a combination of the following: (1) a change in the raw material processes; (2) a process modification; and (3) an add-on control device. A change in raw materials is typically considered for industrial processes that use chemicals, such as solvents, where substitution with a lower emitting chemical may be technically feasible. Likewise, process modifications are typically considered for industrial processes that use chemicals, where a change in the process methods or conditions may result in lower emissions.

The proposed cooling towers, EDGs, and SBOs employ add-on controls to limit PM emissions. The Co-Applicants propose to use a round hybrid mechanical draft cooling tower for the CWS and a rectangular mechanical draft cooling tower for the ESWS. The cooling towers will be equipped with mist eliminators to minimize the drift from each tower that contributes to total PM emissions from Unit 3. The Co-Applicants also propose to use the EDGs and SBOs to provide backup power in the event of a loss of offsite power (LOOP). The EDGs and SBOs will likely employ both in-cylinder and post-combustion controls to minimize the particle formation and emissions also contributing to total PM emissions from Unit 3.

4.1.2 Previous BACT Determinations

Federal and state data sources were reviewed to determine the control technologies that have been previously applied to cooling towers and emergency diesel generators around the country. The review focused on the types of PM control technologies used in these applications, the design and performance of each air pollution control technology, and the incentive for implementing the preferred control measures. The review considered the following databases:

- National database of recently approved PSD permits for electrical power plants;
- Federal and state clearinghouses for air pollution control technology determinations, and
- Air pollutants emission limits established in the various State Implementation Plans.

Each of these databases has certain limitations that hinder either identifying the control devices currently employed at the sources or determining the performance levels actually achieved in practice by the control devices. However, they do reflect the degree of PM emission reduction achievable by the control technologies considered for application to the proposed cooling towers, EDGS, and SBOs at Unit 3.

4.2 Cooling Towers

The Co-Applicants propose to install and operate a hybrid mechanical draft cooling tower for the CWS, which will operate whenever the reactor and turbine generators are in service. They also propose to install and operate four mechanical draft cooling towers for the ESWS, only two of which will operate at any one time. The design and performance data for both the CWS and ESWS cooling towers are summarized in Table 4-1.

Table 4-1 Design and Performance Data for the CWS and ESWS Cooling Towers

Parameter	Units	CWS	ESWS[a]	Total
No. of Units	N.A.	1	4	N.A.
Air Flow Rate	acfm	66.5 million[b]	1.1 million	N.A.
Water Flow Rate	gpm	777,560	19,075	N.A.
Water Density	lb/gal	8.57[c]	8.34	N.A.
Drift Rate	% CW	0.0005	0.005	N.A.
TDS in Circulating Water[d]	ppmw	17,500	372	N.A.
PM_{10}	Fraction	0.80	0.93	NA
$PM_{2.5}$	Fraction	0.13	0.16	NA
Hourly Emissions				
PM_{10}	lb/hr	55.94	0.66	56.56
$PM_{2.5}$	lb/hr	9.09	0.11	9.20
Annual Emissions				
PM_{10}	tpy	245.03	2.89	247.92
$PM_{2.5}$	tpy	39.82	0.50	40.32

[a] Only 2 ESWS cooling towers operate; 2 others are available as backup units.
[b] This flow rate corresponds to operation of the wet section only
[c] Density of brackish re-circulating water at 20°C with a maximum TDS concentration of 35,000 ppm.
[d] TDS is a function of the salinity of the makeup water and the cycles of concentration.

4.2.1 Particulate Formation

The major source of PM emissions at Unit 3 is the drift discharged from both the CWS and ESWS cooling towers. Drift is the relatively small amount of water lost as droplets entrained in the air flow and discharged to the atmosphere. The water droplets are formed because of the mechanical energy generated as the water splashes and flows across the cooling tower film. These droplets contain total dissolved solids (TDS) in the same concentration as in the circulating water. After the droplet leaves the tower, the water evaporates leaving the particles.

4.2.2 Alternative Cooling Processes[1]

The proposed mechanical draft cooling towers are evaporative towers in that they derive their cooling effect from the evaporation that takes place when air and water are brought into direct contact. In dry cooling towers, on the other hand, there is no direct contact that takes place between air and cooling water, but rather steam is condensed by sensible heat in a dry air cooled condenser (ACC). Accordingly, the steam turbine exhaust is transported directly to a steam-to-air heat exchanger, which condenses the steam and returns the condensate to the boiler.

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[1] The emitting units defined by the Application are the CWS and ESWS cooling towers. Therefore, in accordance with established law and EPA policy against "redefining the source" for the purposes of BACT analysis, dry cooling is not appropriately considered as a control in this BACT analysis. A BACT-type evaluation of dry cooling was nevertheless performed and is provided herein for informational purposes.

4.2.2.1 Technical Feasibility

The Co-Applicants evaluated alternative cooling systems as applied to Unit 3 in the report entitled "Cooling Tower and Circulating Water System Study for Calvert Cliffs Unit 3" prepared by the Bechtel Corporation in June 2007. As indicated in this report, the dry (fin-fan) tower array would consist of 550 bays with a moderate profile and rectangular structure. The report found, however, that the distances from the steam generators to the ACC and the size of the steam ducting required for this application (at approximately 26 feet in diameter, it would be by far the largest steam ducting ever attempted) would render the design not feasible. Further, steam turbines with ACCs operate at higher exhaust back pressures than equivalent units with water cooled condensers. The higher exhaust back pressure leads to higher heat rate penalties and loss of capacity. Because ACCs depend on sensible heat of the incoming air, these systems require periods of significant unit power output reduction during periods of high ambient air temperatures. As the Co-Applicants are pursuing the licensing and construction of more technically acceptable alternative systems, ACC was not considered further in the evaluation of alternative cooling systems for Unit 3.

4.2.2.2 Economic Impact

An ACC was nevertheless evaluated as an alternative on the basis of the associated economic, energy, and environmental impacts. For an ACC, the capital cost and annual operating and maintenance cost are significantly higher than those for a hybrid mechanical draft cooling tower. To assess the effectiveness of an ACC in reducing PM emissions, the capital and annual operating costs (O&M) costs were developed for the alternative cooling systems based on information provided in the Bechtel report published in 2007. The annual capital charges then were derived using a capital recovery factor (CRF), assuming an interest rate of 7 percent and amortization period of 20 years. The capital and annual costs for the proposed hybrid mechanical draft cooling tower and the alternative air cooled condenser are summarized in Table 4-2. As can be seen, the cost effectiveness of using dry cooling would be on the order of $97,000 per ton of PM reduced, well above the threshold considered cost effective for PM controls by both the EPA and MDE.

Table 4-2 Cost Effectiveness of an Air-Cooled Condenser in Reducing PM Emissions from Unit 3

Cooling System	Total Capital Cost ($)[a]	Fixed Capital Costs ($)[b]	Variable O&M Costs ($)[c]	Total Annual Costs ($)	Incremental Annual Cost ($)	Annual PM Reduction (tpy)	Cost ($/ton PM)
Mechanical Draft Cooling Tower	$90,000,000	$6,229,740	$900,000	$7,129,740	N.A.	N.A.	N.A.
Air-Cooled Condenser	$269,900,000	$25,475,861	$5,398,000	$30,873,861	$23,744,121	245	$96,915

[a] The capital costs are considered to be order of magnitude and are representative ± 20%.

[b] The fixed capital costs are based on a CRF of 0.09439, assuming an interest rate of 7% and amortization over 20 years.

[c] Variable O&M costs are based on 2 percent of the capital costs and do not include energy costs.

Source: "Cooling Tower and Circulating Water System Study for Calvert Cliffs Unit 3," Bechtel Corporation, June 2007.

4.2.2.3 Energy Impacts

The energy penalties associated with ACC are also significantly higher than those associated with the hybrid mechanical draft cooling tower. As reported in the Bechtel report, the use ACC would result in an approximate 25 percent reduction in the overall thermal efficiency of Unit 3, whereas the proposed cooling tower would result in only a 0.5% reduction. Likewise, the power consumption of the ACC would be approximately 79 MW, compared to that of the proposed cooling tower of 18 MW. These energy penalties, along with the reduction in unit power output during periods of high ambient air temperatures, would threaten the viability of Unit 3.

4.2.2.4 Environmental Impacts

The use of an ACC rather than a wet cooling tower would result in the obvious environmental benefit of reducing PM_{10} emissions from Unit 3 by 245 tpy. However, additional electrical power generation would be required to compensate for the energy penalty associated with the ACC. Because this additional power would most likely be generated at a fossil-fuel-fired power plant, there could be a substantial increase in PM emissions from that facility in the region, somewhat offsetting the net PM reduction at Unit 3. The actual change in regional PM emissions would depend on the type of technology and fuels used at that facility.

4.2.3 Particulate Controls

In wet cooling towers, drift can be minimized by limiting the TDS concentration in the circulating water, maintaining low air velocities, and using high efficiency drift eliminators. In the CWS cooling tower, for example, the maximum expected TDS concentration ever anticipated in the makeup water drawn from Chesapeake Bay will be 17,500 ppm. By managing the cycles of concentration, the maximum TDS concentration in the circulating water will be limited to approximately 35,000 ppm. To minimize entrainment of water droplets in the air stream, air velocities in the cooling tower will be restricted to between approximately 14 ft/sec with only the wet section in operation to 21 ft/sec with both the wet and dry sections in operation. Finally, high efficiency mist eliminators will be designed to limit the drift ultimately discharged to the atmosphere to 0.0005 percent of the circulating water flow of 777,560 gpm. Based on this control efficiency, the maximum PM_{10} emissions from the CWS cooling tower will not exceed 245 tpy.

The ESWS cooling towers have a much lower duty than that of the CWS cooling tower. The maximum expected TDS concentration in the makeup water from the desalination plant will be 372 ppm. Based on limiting the cycles of concentration to 2, the maximum TDS concentration in the circulating water will be 744 ppm. The mist eliminators will be designed to limit the drift discharged to the atmosphere to 0.005 percent of the circulating water flow of 19,075 gpm. Given the size of these cooling towers and extremely low PM emissions, high efficiency drift eliminators (i.e., 0.0005 percent) were not considered necessary for this application. Based on this control efficiency, the maximum PM_{10} emissions from the ESWS cooling tower will be less than 3 tpy, based on only two ESWS cooling towers will operate at any time.

Drift eliminators are industry norm for minimizing both the water and particulate discharge from wet cooling towers. Drift eliminators consist of a series of shaped surfaces, such as a fin or chevrons, which are designed so that the water plume will come into contact with the surface through inertial impaction. The shape of the fin or chevron, as well as the spacing, will each affect the capture and removal of the water droplets and, therefore, particulate matter. The greater contact area will result in greater impaction and, therefore, greater removal of the water droplets.

A review of the RBLC and state databases was conducted to determine the control efficiency of drift eliminators applied to wet cooling towers around the country. Table 4-3 summarizes the level of control approved for drift eliminators applied to recently permitted cooling towers. As shown in this table, typical drift eliminators have removal efficiencies range from a high of 0.01 percent for the earliest installations to a low of 0.0005 percent for the most recent installations, with the smaller percentage indicating a higher level of control.

4.2.4 Proposed Particulate Controls

There are many factors that are used in assessing the technical feasibility of high efficiency drift eliminators. At this time, cooling tower vendors will not guarantee drift eliminator efficiencies lower than 0.0005 percent. Further, the review of the RBLC and state databases clearly illustrates that the efficiencies being contemplated by the Co-Applicants are within the range that other regulators have deemed to be the BACT for those sources. Therefore, the minimization of drift by limiting the TDS concentration in the circulating water, maintaining low air velocities, and using high efficiency drift eliminators is considered representative of BACT for PM emissions from the proposed cooling towers at Unit 3.

Table 4-3 BACT Determinations for Cooling Towers

Facility	Date Issued	Circulating Water Flow (gpm)	Drift Eliminator Efficiency (%)
Entergy Louisiana LLC Little Gypsy Generating Plant	11/10/2007	5,000	0.001
Basin Electric Power Cooperative Dry Fork Station	10/15/2007	N.A.	0.005
Great River Energy Spiritwood Station	09/14/2007	N.A	0.0005
Western Greenbrier Cogeneration LLC Western Greenbrier	04/26/2006	55,000	0.0005
Cleco Power Rodemacher Brownfield Unit 3	02/23/2006	301,874	0.0005
Diamond Wanapa I LP Wanapa Energy Center	08/08/2005	3,532	0.0005
Public Service Company of Colorado Comanche Station	07/05/2005	140,650	0.0005
Newmont Nevada Energy Corporation TS Power Plant	05/05/2005	N.A	0.0005
Omaha Public Power District Nebraska City Station	03/09/2005	N.A	0.0005
Darrington Energy LLC Darrington Energy Center	02/11/2005	N.A	0.001
BP West Coast Products LLC BP Cherry Point Cogeneration Project	01/11/2005	N.A	0.001
Dome Valley Energy Partners Wellton Mohawk Generating Station	12/01/2004	170,000	0.0005
Wisconsin Public Service WTS Weston Plant	11/19/2004	N.A	0.002
Entergy New Orleans, Inc. Michoud Electric Generating Plant	10/12/2004	1,728	0.005 (Design 0.001)
Longview Power LLC Maidsville Station	03/02/2004	5,000	0.001
Allegheny Energy Supply LLC La Paz Generating Facility	09/04/2003	141,400 173,870	0.0005 0.0005
MidAmerican Energy Company MidAmerican Energy Plant	06/17/2003	349,400	0.001
Wallula Generation LLC Wallula Generation Power Plant	01/03/2003	N.A	0.0005
Interstate Power & Light Emery Generating Station	12/20/2002	140,000	0.005
Genova Arkansas I LLC Genova Arkansas I	08/27/2002	190,000	0.001
Mustang Power Mustang Energy Project	02/12/2002	N.A	0.004
Mustang Power Horseshoe Energy Project	02/12/2002	111,438	0.001
Venture Lease Company LLC Plaquemine Cogeneration Facility	12/26/2001	N.A	0.01
Source: EPA RACT/BACT/LAER Clearinghouse at http://cfpub.epa.gov/rblc/htm/bl02.cfm.			

4.3 Emergency Diesel Generators

The Co-Applicants propose to install four EDGs and two SBOs to provide backup power in the event of loss of offsite power (LOOP) at Unit 3. Normal operation of the EDGs and SBOs generators will be limited to periodic testing and maintenance activities to insure readiness and operability. Each EDG unit will be tested for four hours each month, with an additional 24 to 48 hours of operation once every two years. Each SBO unit will be tested approximately 4 hours every quarter, with an additional 12 hours every year for maintenance and extended testing for 12 hours every 18 months. Table 4-4 presents the design and performance data for the EDGs and SBOs.

Table 4-4 Design and Performance Data for EDGs and SBOs (Per Unit)

Parameter	Units	EDGs	SBOs	Total
No. of Engines	N.A.	4	2	N.A.
Engine Size (100% capacity)	kWe	10,130	5,000	N.A.
Hourly Firing Rate	Gph	630	332	N.A.
Hours of Operation	hr/yr	150	100	N.A.
Annual Firing Rate	Gpy	94500	33200	N.A.
Emission Factors				
PM	g/kW-hr	0.15[a]	0.50[b]	N.A.
PM_{10}	g/kW-hr	0.15	0.50	N.A.
$PM_{2.5}$	g/kW-hr	0.15	0.49	N.A.
Hourly Emissions				
PM_{10}	lb/hr	3.35	5.51	24.42
$PM_{2.5}$	lb/hr	3.25	5.35	23.70
Annual Emissions				
PM_{10}	Tpy	0.25	0.28	1.56
$PM_{2.5}$	Tpy	0.24	0.27	1.50

[a] Based on compliance with 40 CFR 60.4205(d).
[b] Based on compliance with 40 CFR 60.4205(b).

Aside from maintenance testing, the EDGs and SBOs will operate during certain non-normal conditions associated with a LOOP event in order to provide power to the plant for a safe shutdown. In the event of a LOOP event, Unit 3 will be designed to operate in an "island mode," where the main generator continues to provide power to the plant loads without interruption and without need for backup power. In most cases, the offsite power would be restored within 24 hours, and plant operations would return to normal. However, in the very unlikely event that the "island mode" fails or the LOOP event lasts more than 24 hours (the maximum duration of the island mode operational state), then the EDGs would be activated to assist in a safe plant shutdown. During a LOOP event for which "island power" is also lost, the CWS cooling tower would not be operated, but the backup power would be used to power the ESWS cooling towers.

The NSPS rely, in part, on the regulations governing emissions from nonroad compression ignition internal combustion engines promulgated by the EPA. In the event that none of the EDGs are operational in the case of a LOOP event and a failure of the island mode (a "beyond design basis" event), then power will be supplied by the two SBOs that serve as a backup to the EDGs. The NRC license design documentation for station blackout coping indicates that the SBO generators would be required to operate for no more than 8 hours, during which the plant will be safely shut down if offsite power is not restored.

4.3.1 Particulate Formation

Particulate matter emitted from diesel engines is comprised of four components: solid carbon soot, volatile and semi-volatile organic matter, inorganic solids (ash), and sulfates. The formation mechanisms for each of these components varies with engine design and the control of the various components requires different control techniques given their chemical properties.

The formation of the solid carbon soot portion of PM is inherent in diesel engines due to the heterogeneous distribution of fuel and air in a diesel combustion system. Diesel combustion is designed to allow for overall lean (excess oxygen) combustion with high efficiencies and low CO and VOC emissions, with a small region of rich (excess fuel) combustion within the fuel-injection plume. It is within this excess fuel region that PM is formed when high temperatures and a lack of oxygen cause the fuel to pyrolize, forming soot. Much of the soot formed in the engine is burned during the combustion process as the soot is mixed with oxygen in the cylinder at high temperatures. Any soot that is not fully oxidized before the exhaust valve is opened is emitted from the engine as diesel PM.

The volatile and semi-volatile organic material in diesel PM, commonly referred to as the soluble organic fraction (SOF), is primarily composed of engine oil that passes through the engine with only partial oxidation and condenses in the atmosphere to form PM. The SOF portion of diesel PM can be reduced through reductions in engine oil consumption and through oxidation of the SOF catalytically in the exhaust.

The inorganic solids (ash) in diesel PM comes primarily from metals found in engine oil and to certain extent from engine wear. Although ash represent a very small portion of total PM with no impact on compliance with PM emission standards, it does impact maintenance of PM filter technologies because in aggregate over a long period of time ash accumulation in the PM filter can reach a level such that it must be cleaned from the filter.

The sulfate portion of diesel PM is formed from sulfur present in diesel fuel and engine lubricating oil that oxidizes to form sulfuric acid (H_2SO_4) and then condenses in the atmosphere to form sulfate PM. Oxidation catalyst technologies applied to control the SOF and soot portions of diesel PM can inadvertently oxidize SO_2 in the exhaust to form additional sulfate PM. With low-sulfur diesel fuel, however, sulfate PM constitutes a very small portion of total PM.

4.3.2 Alternative Particulate Controls

To date, diesel engine manufacturers have employed both in-cylinder controls and post-combustion controls, such as diesel oxidation catalysts and catalyzed diesel particulate filter, to limit PM emissions. These control techniques continue to evolve to comply with the ever more stringent PM emissions standards established in the NSPS for Compression Ignition Internal Combustion Engines promulgated by the EPA in July 2005 (40 CFR 60, Subpart IIII).

In-Cylinder PM Controls

The soot portion of PM emissions can be reduced by increasing the availability of oxygen within the cylinder during combustion or by increasing the mixing of the fuel and oxygen within the cylinder. Several current technologies can influence oxygen availability and in-cylinder mixing, including improved fuel-injection systems, air management systems, and combustion system designs. Many of these PM-reducing technologies offer better control of combustion in general and better utilization of fuel allowing for improvements in fuel efficiency concurrent with reductions in PM emissions. In general, the application of in-cylinder emission controls for PM is more successful as engine size increases. This occurs for several reasons, including: larger engines have a higher volume to surface area ratio within the cylinder reducing the proportion of the in-cylinder volume near a cooler cylinder wall; larger engines operate at lower engine speeds reducing oil consumption that contributes to SOF and providing longer residence time for more complete combustion; and larger engines operate over a narrow engine speed range allowing for better matching of turbomachinery to the engine.

Diesel Oxidation Catalysts

Diesel oxidation catalysts (DOCs) are the most common form of post-combustion technology today and have been used for compliance with the PM standards for some highway engines since the early 1990s. DOCs reduce PM by oxidizing a small portion of the soot emissions and a significant portion of the SOF emissions. Total DOC effectiveness to reduce PM emissions is normally limited to approximately 30 percent because the SOF portion of diesel PM for modern diesel engines is typically less than 30 percent and because the DOC increases sulfate emissions, reducing the overall effectiveness of the catalyst. Limiting fuel sulfur levels to 15 ppm allows DOCs to be designed for maximum effectiveness (nearly 100% control of SOF with highly active catalyst technologies) since their control effectiveness is not reduced by the formation of significant quantities of sulfate PM. However, DOCs are less effective at controlling the solid carbon soot portion of PM. Soot typically constitutes 60 to 90 percent of the total PM emissions. Even with low-sulfur fuel, DOCs would therefore not be able to achieve the level of PM control needed to meet the PM emission standards established in the NSPS. As noted above, however, DOCs can be an effective means of achieving emission reductions on the order of 20 to 50 percent even when operated on 500 ppm sulfur diesel fuel and thus may be used by some manufacturers as a means to reduce emissions to comply with the NSPS.

Catalyzed Diesel Particulate Filters

Emission levels from a catalyzed diesel particulate filter (CDPF) are determined by several factors. Filtering efficiencies for solid particle emissions like soot are determined by the characteristics of the PM filter, including wall thickness and pore size. Some of these characteristics represent a tradeoff between mechanical strength, weight, size and filtering efficiency. Filtering efficiencies for ceramic based diesel soot filters can be as high as 99 percent with the appropriate filter design. For some wire mesh or ceramic fiber filter technologies, the filtering efficiency is much lower, around 70 percent, but the mechanical strength (resistance to thermal and mechanical stress) is improved, especially for very large filter sizes. The level of soot emission control is much less dependent on engine test cycle or operating conditions due to the mechanical filtration characteristics of the particulate filter.

Control of the SOF portion of diesel soot is accomplished on a CDPF through catalytic oxidation. At the elevated temperature of diesel exhaust, the SOF portion of diesel PM consists primarily of gas-phase hydrocarbons, which later form particulate matter in the environment with the condensation of the SOF. Catalytic materials used with CDPFs can oxidize a substantial fraction of the SOF, just as the SOF portion is oxidized by a DOC. If a manufacturer's base engine technology has high oil consumption rates and therefore high SOF emissions, compliance with the NSPS may require additional technology beyond the application of a CDPF system alone. For highway vehicles, the manufacturers have controlled SOF emissions by controlling oil consumption through the use of engine modifications (e.g., piston ring design, the use of 4-valve heads, the use of valve stem seals, etc.). The manufacturers of nonroad diesel engines may similarly need to control SOF emissions to comply with the NSPS.

As previously discussed, CDPFs control PM emissions by capturing the soot portion of PM in a filter media and then by oxidizing it in the oxygen-rich atmosphere of diesel exhaust. The SOF portion of diesel PM can be controlled through the addition of catalytic materials to the CDPF. The catalytic material is also very effective to promote soot burning. This burning off of collected PM is referred to as "regeneration." With the addition of a catalytic coating on a CDPF, the temperature necessary to ensure regeneration is decreased significantly to approximately 500°F, a temperature within the normal operating range for most diesel engines. Similar to DOCs, sulfur both degrades catalyst oxidation efficiency (i.e., poisons the catalyst) and forms sulfate PM. The use of low-sulfur diesel fuel will minimize catalyst poisoning and sulfate formation.

Previous BACT Determination

A review of the RBLC and state databases was conducted to determine the PM emission limits imposed on emergency diesel generators around the country. This review was limited to emergency diesel generator to be reflective of large diesel engines being installed at Unit 3 with a displacement on the order of 30 liters per cylinder. Table 4-5 summarizes the PM emission levels approved as BACT for large emergency diesel generators by the EPA and various state regulators. As shown in this table, the PM emissions levels range for these diesel generators from 0.23 to 0.65 primarily depending on the date of installation. It should be noted that these diesel generators were installed prior to promulgation of the NSPS for Compression Ignition Internal Combustion Engines in June 2006.

Table 4-5 BACT Determinations for Large Emergency Diesel Generators

Facility	Date Issued	Rated Generating Capacity (kWe)	PM/PM_{10} Emission Limit (g/kWh)
Nome Joint Utilities System Snake River Power Plant	11/05/04	5,200	0.23
AES Red Oak, LLC	10/24/01	5,100	0.23
Puerto Rico Electric Authority San Juan Repowering Project	03/02/00	5,000	0.65
Source: EPA RACT/BACT/LAER Clearinghouse at http://cfpub.epa.gov/rblc/htm/bl02.cfm.			

4.3.3 Proposed Particulate Controls

At this time, the Co-Applicants have not yet selected the diesel engine models for backup power required for Unit 3, but rather have decided to delay the selection until the time of purchase to take advantage of the evolution in diesel engine controls mandated under the NSPS. At a minimum, the proposed EDGs and SBOs will be designed to comply with the current PM emissions standards set forth in 40 CFR 60, Subpart IIII. For diesel engines with a displacement equal to or greater than 30 liters per cylinder, the standards require that particulate emissions must be reduced by at least 60 percent or must be limited to 0.15 g/kWh [40 CFR 60.4205(d)]. For diesel engines with a displacement equal to or greater than 25, but less than 30 liters per cylinder, particulate emissions must be limited to the standard for marine diesel engines of 0.50 g/kWh [40 CFR 60.4205(b)].

The NSPS defer to the regulations governing emissions from nonroad compression ignition internal combustion engines promulgated by the EPA under 40 CFR Parts 89, 91, and 1039. These standards are intended to mandate improvements in the performance of diesel engine controls over a period of years. To comply with these technology-forcing regulations, the various diesel engine manufacturers will have to employ a combination of in-cylinder and post-combustion controls. Because the engines will comply with the recently published NSPS, the use of emergency diesel engines equipped with state-of-the-art controls, the use of low-

sulfur diesel fuel oil, and the limited use of the emergency diesel generator are considered representative of BACT for PM.

5.0 Dispersion Modeling Analysis: PSD Class II Impacts

5.1 Overview

This section presents the modeling analysis that was conducted to assess ambient air quality impacts which will demonstrate compliance with applicable state and federal ambient air quality regulations. The analyses were conducted in accordance with USEPA Guideline on Air Quality Models (GAQM; as incorporated in Appendix W of 40 CFR Part 51). Note that the USEPA recently promulgated a revision to the GAQM on November 9, 2005. The revised version of GAQM adopts AERMOD as the preferred dispersion model.

Dispersion modeling was conducted with the US EPA's AERMOD model (Version 07026) and five years of on-site meteorological data. This 5-year data set was processed with AERMET, the meteorological processor for AERMOD, in accordance with guidance provided by US EPA in the recently revised *AERMOD Implementation Guide* (AIG; US EPA, January 9, 2008).

5.2 Model Selection Criteria

The suitability of an air quality dispersion model for a particular application is dependent upon several factors. For this study, the following selection criteria have been evaluated:

- stack height relative to nearby structures,
- dispersion environment,
- local terrain, and
- availability of on-site or representative meteorological data.

5.2.1 Good Engineering Practice Stack Height

Good engineering practice (GEP) stack height is defined as the stack height necessary to ensure that emissions from the stack do not result in excessive concentrations of any air pollutant as a result of atmospheric downwash, wakes or eddy effects created by the source, nearby structures or terrain features. In a setting where the close-in terrain is considered simple, the GEP stack height is calculated as the height of nearby structures plus 1.5 times the lesser dimension of the height or projected width of the nearby structures. The GEP height will be determined using the US EPA Building Profile Input Program (BPIP) that performs the GEP calculation for a multi-building complex on a stack-by-stack basis.

GEP stack height calculations were conducted for the proposed Unit 3 combustion sources as well as the CSW and ESWS cooling towers in accordance with US EPA's modeling guidelines. The design specifications for Unit 3 emissions sources and buildings are depicted in Figure 2-2. The GEP height for each modeled stack, H_{GEP}, is determined from the dimensions of all buildings which are within the region of influence:

$$H_{GEP} = H + 1.5L$$

where:

H = height of the structure within 5L of the stack which maximizes Hg, and

L = lesser dimension (height or projected width) of the structure.

For a squat structure, i.e., height less than projected width, the formula reduces to:

$$H_{GEP} = 2.5H$$

In the absence of influencing structures, a "default" GEP stack height is credited up to 65 meters (213 feet). All of the modeled point sources were assessed with EPA's BPIP software to determine the appropriate model inputs that account for building downwash effects.

5.2.2 Dispersion Environment

The application of the model requires characterization of the local (within 3 kilometers (km)) dispersion environment as either urban or rural, based on a US EPA-recommended procedure that characterizes an area by prevalent land use. This land use approach classifies an area according to 12 land use types. In this scheme, areas of industrial, commercial, and compact residential land use are designated urban. According to US EPA modeling guidelines, if more than 50 percent of an area within a three-kilometer radius of the proposed facility is classified as rural, then rural dispersion coefficients are to be used in the dispersion modeling analysis. Conversely, if more than 50% of the area is urban, urban dispersion coefficients are used.

For this analysis, an aerial photo and a topographical map of the facility area has been reviewed. Visual inspection of the map shows that the 3-kilometer area surrounding the proposed facility (see Figure 1-1) is predominantly rural. Therefore, a rural application approach was chosen for this dispersion modeling analysis.

5.2.3 Terrain Considerations

The US EPA modeling guidelines require that the differences in terrain elevations between the stack top, plume centerline and model receptor locations be considered in the modeling analyses. There are three types of terrain:

- simple terrain – locations where the terrain elevation is at or below the exhaust height of the stacks to be modeled;
- intermediate terrain – locations where the terrain is between the top of the stack and the modeled exhaust "plume" centerline (this varies as a function of plume rise, which in turn, varies as a function of meteorological condition);
- complex terrain – locations where the terrain is above the plume centerline.

Based on a review of USGS topographical maps, the terrain within the study area is all simple terrain with respect to the Unit 3 sources.

5.3 Representative Meteorological Data

For this analysis, five calendar years of on-site (2001-2005) meteorological data were used. The meteorological tower for the CCNPP site is located in an open field southwest of the CCNPP Unit 1 and 2. The base elevation of the tower is approximately 120.6 ft (37 m) above mean sea level (msl). 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. The onsite meteorological monitoring program was designed, and has been operated, according to U.S. NRC Regulatory Guide 1.23, Revision 0. This guidance includes the following specifications for meteorological measurements at the 10-m and 60-m levels:

- wind direction accuracy of +/- 5 degrees;
- wind speed accuracy of +/- 0.5 mph, with a starting threshold of under 1 mile per hour;
- temperature accuracy of +/- 0.5 deg C, and delta-T accuracy of +/- 0.1 deg C.

These system accuracies are consistent with United States Environmental Protection Agency (USEPA) guidance for on-site meteorological programs.

The data recovery goal of 90% was met for each of five years of data (2001 through 2005). Figures 5-1 and 5-2 show multi-year wind roses from the 33-ft and 197-ft tower levels.

Upper air data for the concurrent period is available from the Washington Dulles Airport, Virginia (KIAD), twice-daily soundings. For parameters not observed by the on-site meteorological instrumentation, such as cloud cover, hourly observations are available from the closest representative airport, Washington Reagan Airport, Virginia (KDCA).

The location of the on-site meteorological tower relative to the Project sources is shown in Figure 2-1.

Figure 5-1 On-site Meteorological Tower Wind Rose, 33-ft Level

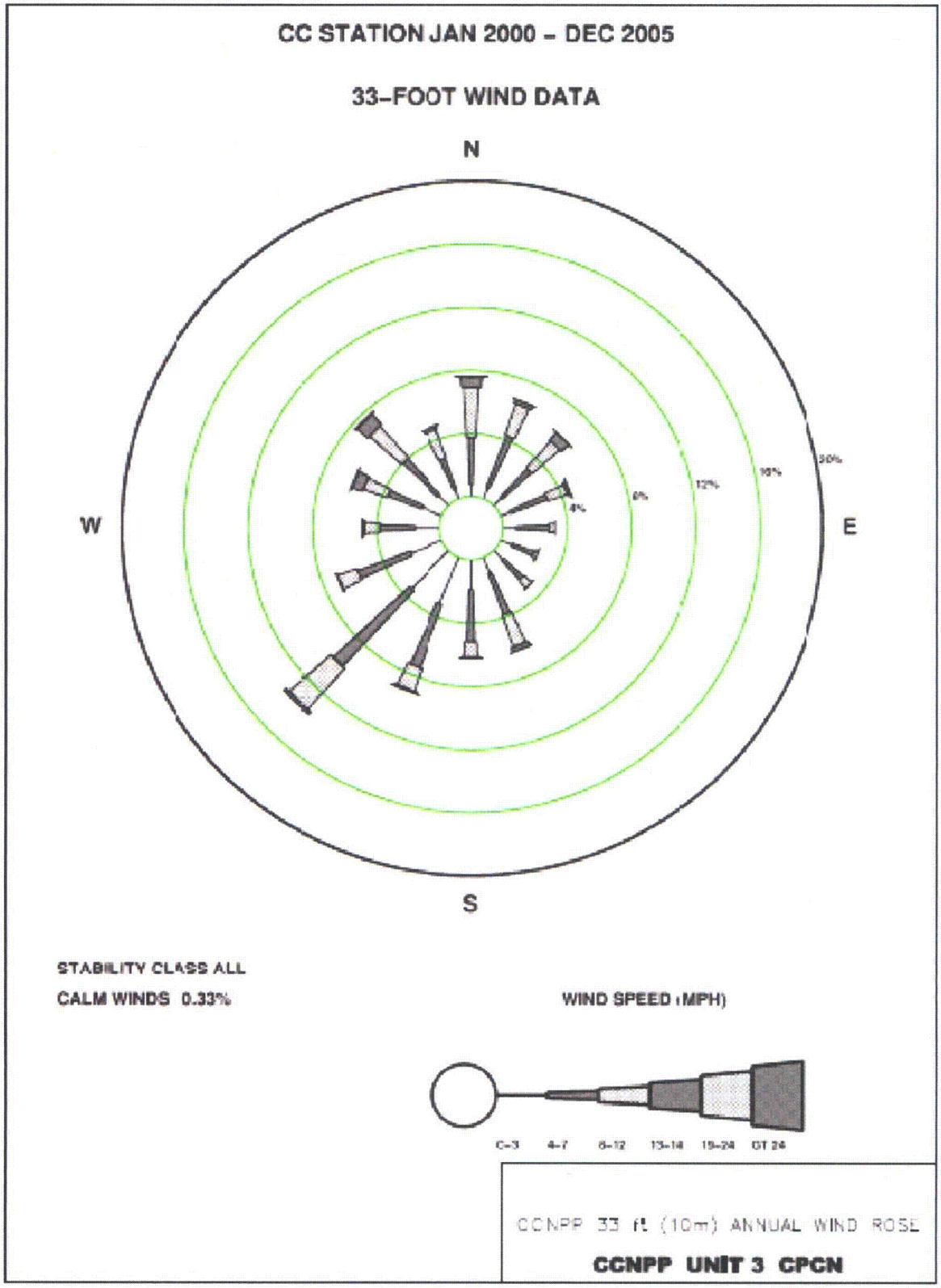
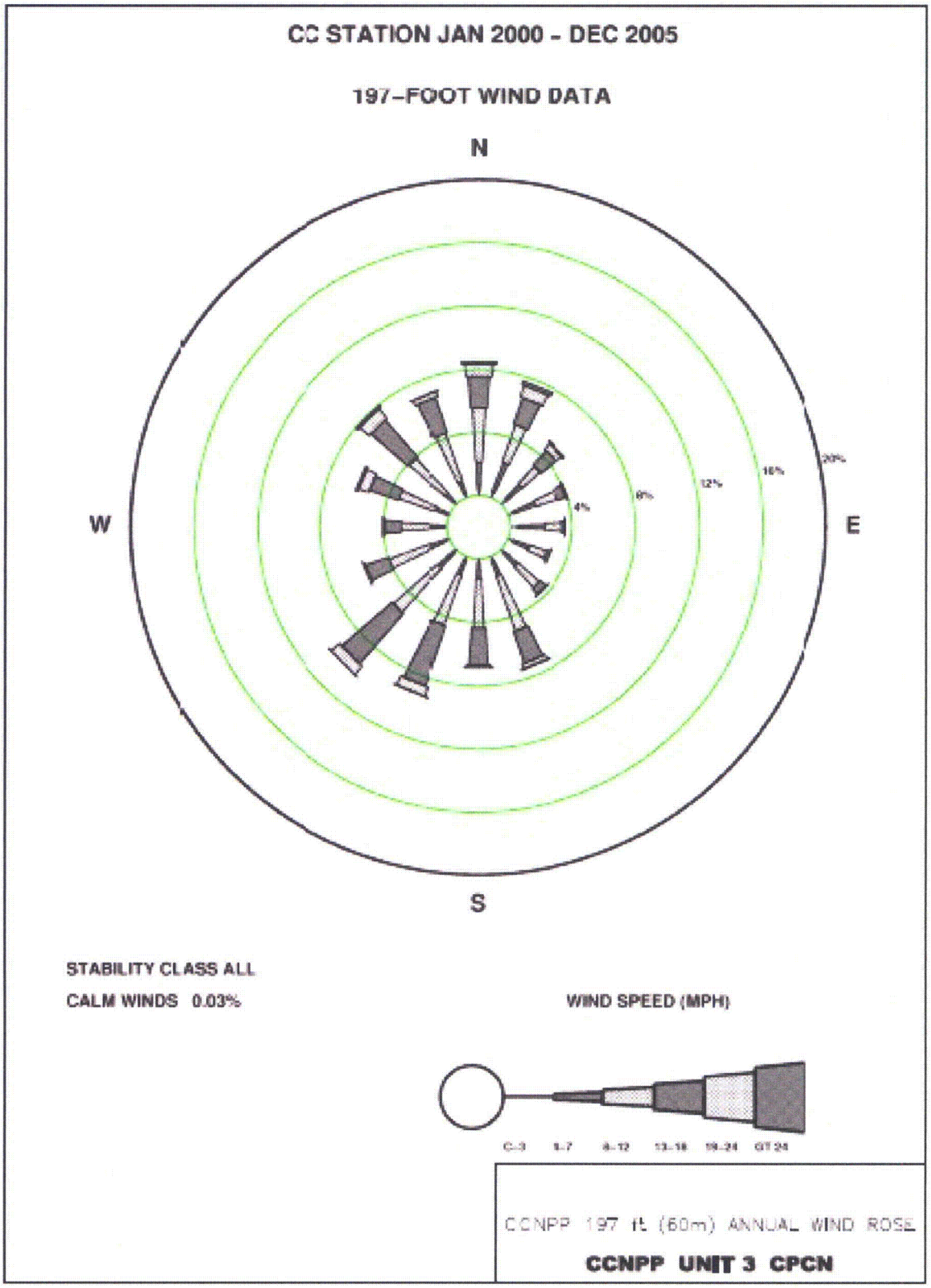


Figure 5-2 On-site Meteorological Tower Wind Rose, 197-ft Level



5.4 Dispersion Model Selection and Application

Based on a review of the factors discussed above, US EPA's preferred dispersion model, AERMOD, was used to assess air quality impacts. AERMOD is a state-of-the-art dispersion model that incorporates modeling improvements especially for applications involving building downwash. The latest version of AERMOD (07026), the AERMET (06341) meteorological preprocessor, and the AERMAP (06341) terrain preprocessor was used in this application. In the application of AERMOD, the regulatory default options were used.

5.4.1 Terrain and Receptor Data Processing with AERMAP

A comprehensive Cartesian receptor grid extending to approximately 7 km from the Unit 3 site was used in the AERMOD modeling to assess maximum ground-level pollutant concentrations. This receptor grid was sufficient to resolve the maximum impacts and any potential significant impact area(s).

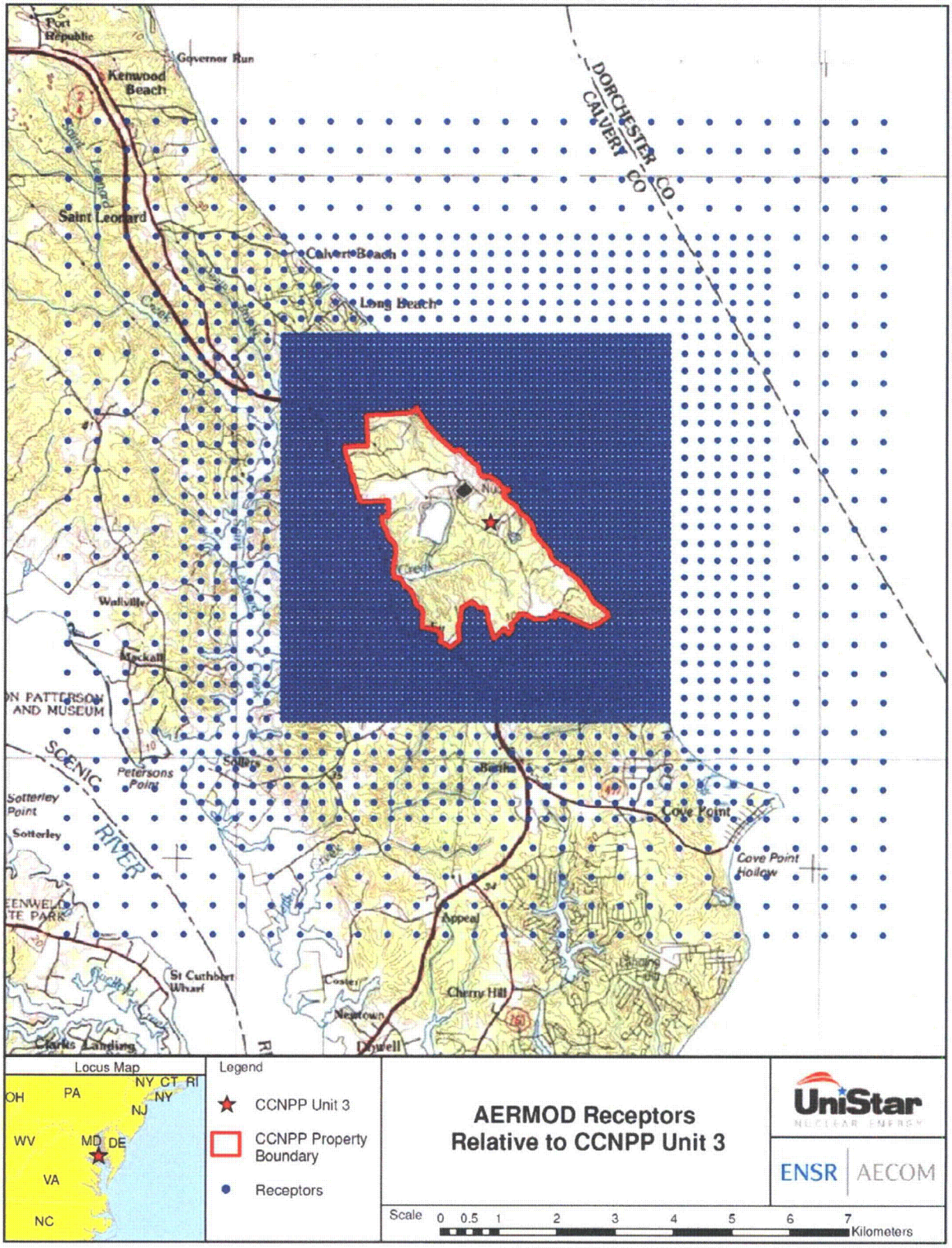
The Cartesian receptor grid consisted of the following receptor spacing:

- property boundary to approximately 1 kilometer at 100-meter increments,
- beyond 1 kilometer to 3 kilometers at 300-meter increments, and
- beyond 3 kilometers at 500-meter increments

Discrete receptors were placed at 100-meter intervals along the plant property boundary.

The AERMAP receptor locations are shown in Figure 5-3. Terrain elevations from Digital Elevation Model (DEM) data acquired from USGS were processed with AERMAP (Version 03107) to develop the receptor terrain elevations and corresponding hill height scale required by AERMOD.

Figure 5-3 AERMOD Receptors



5.4.2 Meteorological Data Processing with AERMET

The meteorological data required for input to AERMOD was created with AERMET (Version 06341), the meteorological preprocessor, which utilizes hourly on-site weather data, nearby cloud cover data from Washington National Airport, and concurrent upper air sounding data from Washington Dulles Airport, VA. (Note that the poor data capture for the Patuxent River Naval Air Station precluded use of that meteorological station for input to AERMET.) AERMET creates two output files for input to AERMOD:

- SURFACE: a file with boundary layer parameters such as sensible heat flux, surface friction velocity, convective velocity scale, vertical potential temperature gradient in the 500-meter layer above the planetary boundary layer, and convective and mechanical mixing heights. Also provided are values of Monin-Obukhov length, surface roughness, albedo, Bowen ratio, wind speed, wind direction, temperature, and heights at which measurements were taken.
- PROFILE: a file containing multi-level meteorological data with wind speed, wind direction, temperature, sigma-theta (σ_θ) and sigma-w (σ_w) when such data are available. For this application involving on-site, the profile file contains a two levels (10-m and 60-m) of wind data and temperature data.

AERMET requires specification of site characteristics including surface roughness (z_o), albedo (r), and Bowen ratio (B_o). These parameters were developed according to the guidance provided by US EPA in the recently revised AERMOD Implementation Guide (AIG).

The revised AIG provides the following recommendations for determining the site characteristics:

1. The determination of the surface roughness length should be based on an inverse distance-weighted geometric mean for a default upwind distance of 1 kilometer relative to the measurement site. Surface roughness length may be varied by sector to account for variations in land cover near the measurement site; however, the sector widths should be no smaller than 30 degrees. As discussed below, 3 sectors were used in this application.
2. The determination of the Bowen ratio should be based on a simple un-weighted geometric mean (i.e., no direction or distance dependency) for a representative domain, with a default domain defined by a 10-km by 10-km region centered on the measurement site.
3. The determination of the albedo should be based on a simple un-weighted arithmetic mean (i.e., no direction or distance dependency) for the same representative domain as defined for Bowen ratio, with a default domain defined by a 10-km by 10-km region centered on the measurement site.

The AIG recommends that the surface characteristics be determined based on digitized land cover data. US EPA has developed a tool called AERSURFACE that can be used to determine the site characteristics based on digitized land cover data in accordance with the recommendations from the AIG discussed above. AERSURFACE incorporates look-up tables of representative surface characteristic values by land cover category and seasonal category. AERSURFACE will be applied with the instructions provided in the *AERSURFACE User's Guide* (EPA, 2008).

The current version of AERSURFACE (Version 08009) supports the use of land cover data from the USGS National Land Cover Data 1992 archives[4] (NLCD92). The NLCD92 archive provides data at a spatial resolution of 30 meters based upon a 21-category classification scheme applied over the continental U.S. The

[4] http://edcftp.cr.usgs.gov/pub/data/landcover/states/

AIG recommends that the surface characteristics be determined based on the land use surrounding the site where the surface meteorological data were collected.

Since 1992, there has some conversion of the land south of the meteorological tower to native ground cover. However, that area is slated to be affected by the construction of Unit 3, will be cleared (see CPCN Technical Document, Figure 2.1-1), and will end up more like the 1992 land use characterization. Therefore, the 1992 land use characterization is reasonably representative for this application.

As recommended in the AIG for surface roughness, the 1-km radius circular area centered at the tower site can be divided into sectors for the analysis; each chosen sector has a mix of land uses that is different from that of other selected sectors. Three sectors were used for this analysis based upon visual observation of the land use about the site as shown on the land cover image (see Figure 5-4).

In AERSURFACE, the various land cover categories are linked to a set of seasonal surface characteristics. As such, AERSURFACE requires specification of the seasonal category for each month of the year. The following five seasonal categories are supported by AERSURFACE, with the applicable months of the year specified for this site.

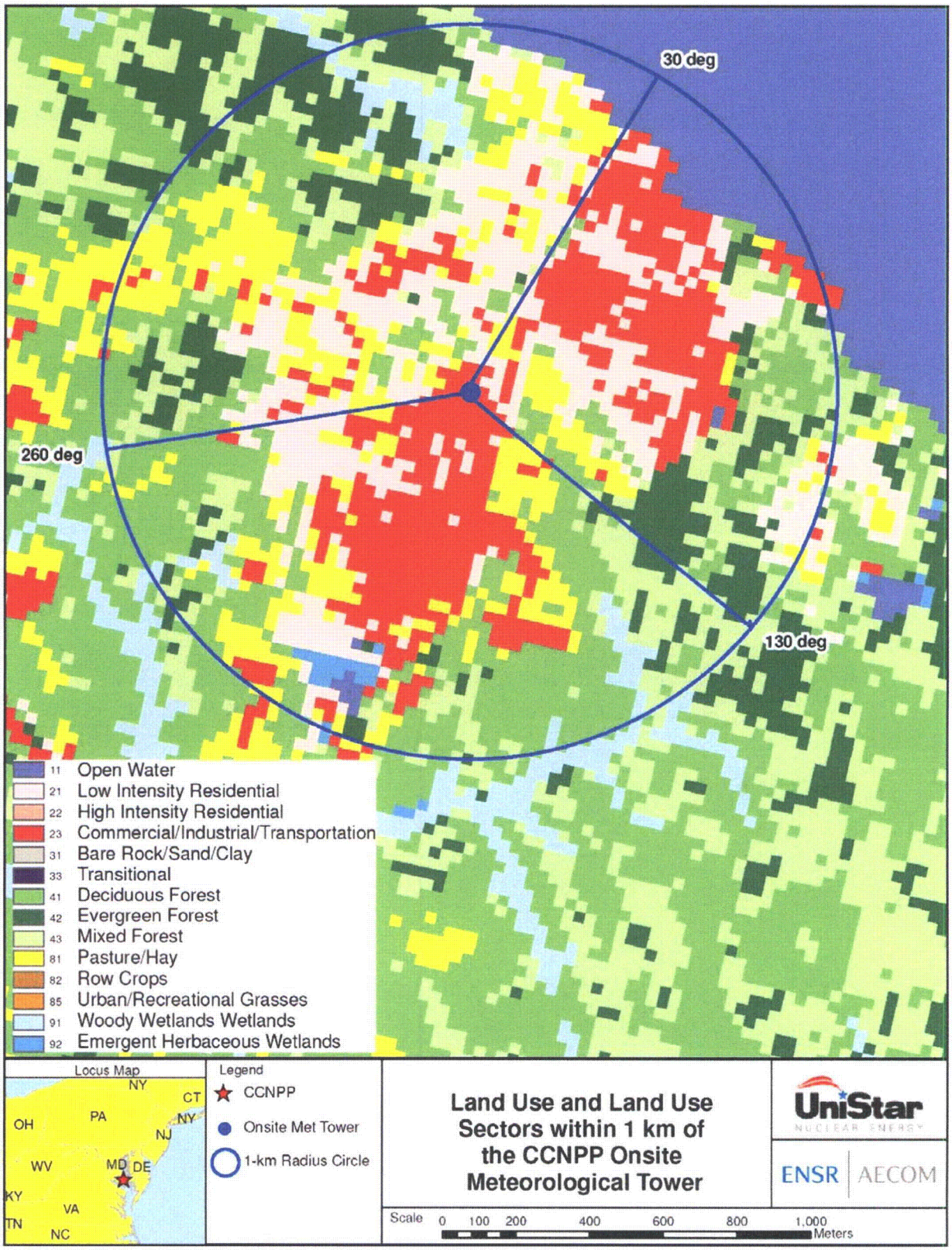
1. Midsummer with lush vegetation (May-September).
2. Autumn with un-harvested cropland (October-November).
3. Late autumn after frost and harvest, or winter with no snow (January, February, December).
4. Winter with continuous snow on ground (Not present).
5. Transitional spring with partial green coverage or short annuals (March-April).

For Bowen ratio, the land use values are linked to three categories of surface moisture corresponding to average, wet and dry conditions. The surface moisture condition for the site may vary depending on the meteorological data period for which the surface characteristics will be applied. AERSURFACE applies the surface moisture condition for the entire data period. Therefore, if the surface moisture condition varies significantly across the data period, then AERSURFACE can be applied multiple times to account for those variations. As recommended in AERSURFACE User's Guide, the surface moisture condition for each month were determined by comparing precipitation for the period of data to be processed to the 30-year climatological record (for this application Washington Reagan Airport was used), selecting "wet" conditions if precipitation is in the upper 30th-percentile, "dry" conditions if precipitation is in the lower 30th-percentile, and "average" conditions if precipitation is in the middle 40th-percentile. The monthly designations of surface moisture input to AERSURFACE are also summarized in Table 5-1.

Table 5-1 AERSURFACE Bowen Ratio Condition Designations

Month	Bowen Ratio Category				
	2001	2002	2003	2004	2005
January	Dry	Dry	Average	Dry	Wet
February	Average	Dry	Wet	Average	Dry
March	Average	Average	Average	Dry	Wet
April	Dry	Average	Average	Wet	Wet
May	Average	Dry	Wet	Average	Wet
June	Wet	Wet	Wet	Average	Average
July	Wet	Dry	Wet	Wet	Average
August	Average	Dry	Wet	Wet	Average
September	Dry	Average	Wet	Average	Dry
October	Dry	Wet	Wet	Dry	Wet
November	Dry	Average	Average	Wet	Dry
December	Dry	Wet	Wet	Average	Average

Figure 5-4 Land-Use Sectors within 1 km of On-Site Meteorological Tower



5.4.3 Emission Source Input

The PM_{10} modeling runs for Unit 3 emissions were conducted for three cases associated with normal operations as well as for two backup power cases as discussed in Section 3. The emergency generators are only required to supply station power in the absence of grid power when the station itself needs to be shut down safely, which is a very unlikely situation. Use of the SBOs as a backup to the EDGs is even more unlikely. Section 3.1 describes the routine testing program followed by the EDGs and SBOs. The hours devoted to backup power engine testing leave an annual reserve of at least 216 engine-hours for the EDGs (at an equivalent 100% load fuel usage) and at least 120 engine-hours for the SBOs to cover the need for backup power.

The stack exhaust parameters for the cooling towers and the emergency generators are specified using vendor data or best engineering judgment and are listed in Table 2-3. The EDGs and SBOs were modeled as point sources with appropriate building influences as determined by the BPIP building pre-processor.

The CWS cooling tower was modeled as a point source with a stack temperature that varies hourly, as described in Section 3.2. The modeling considered the cooling tower structure as a candidate downwash controlling structure. As noted in that section's discussion, we believe that AERMOD is the appropriate model to use for modeling the cooling tower emissions. Use of models such as AERMOD that do not consider the thermodynamics effects of a moist plume will underestimate the plume rise resulting in conservatively high impacts.

The ESWS cooling towers resemble open elevated area sources, and they were conservatively modeled as such, not accounting for the plume buoyancy.

For sources that operate less than a full day (such as the single hour of the four EDGs or 8 hours of the SBOs), additional modeling was conducted for these sources to define the portion of the day that is the worst case for sub-daily emission durations. For example, the worst-case single hour of the day for the EDGs was determined by analyzing hourly results for the 4 EDGs and selecting the worst-case hour for the 4 EDG emissions. The remaining 23 hours of a day accommodated emissions from the 2 EDGs for emergency Case 1. For SBO testing (12 hours per day) or SBO emergency operation (8 hours per day), the emissions were tested at various portions of the day to find the worst-case period. For example, the 12-hour emissions were tested for 12-hour periods starting at midnight, 6 AM, noon, and 6 PM, and the worst case were used in the modeling. In addition, the 8-hour emissions were tested for 8-hour periods starting at midnight, 4 AM, 8 AM, noon, 4 PM, and 8 PM to find the worst-case 8-hour period.

5.4.4 $PM_{2.5}$ NAAQS Compliance Analysis

After the promulgation of the $PM_{2.5}$ National AAQS in 1997, USEPA determined that it does not have a suitable technical approach for modeling $PM_{2.5}$ concentrations. Therefore, USEPA established a policy to use the implementation of the New Source Review program for PM_{10} as a surrogate for $PM_{2.5}$ compliance until the necessary tools are in place to model $PM_{2.5}$ concentrations. This policy was articulated in a memorandum (Interim Implementation of New Source Review for $PM_{2.5}$) from John S. Seitz (Director of US EPA's Office of Air Quality Planning and Standards) to Regional Air Directors on October 23, 1997. This policy is still in effect (reaffirmed on April 5, 2005 in "Implementation of New Source Review Requirements in $PM_{2.5}$ Non-attainment Areas," by Stephen D. Page, Director, EPA Office of Air Quality Planning & Standards. The Co-Applicants propose to use compliance with the NAAQS for PM_{10} as a surrogate for compliance with the $PM_{2.5}$ NAAQS. Mr. William Harnett, Director of EPA's Air Quality Policy Division, has indicated (2007) that the PM_{10} surrogate policy remains in effect for attainment areas until the $PM_{2.5}$ New Source Review State Implementation Rule is promulgated and the required State Implementation Plan for Maryland is adopted by EPA.

5.5 Ambient Air Impact Criteria

The US EPA Significant Impact Levels (SILs), NAAQS and PSD Class II increments are summarized for PM_{10}, the only PSD-applicable pollutant, as well as other criteria pollutants in Table 5-2. Based on standard modeling practice and agency guidance, the PM_{10} modeling results for the proposed Unit 3 sources alone were first compared to the SILs. If the modeled impacts are below SILs, no further analysis was required and the proposed source's effect upon the compliance status with the NAAQS is considered to be negligible. If the proposed Unit 3 sources modeled impacts are greater than the SILs, compliance with the NAAQS would be based upon cumulative multi-source modeling of the Unit 3 sources and any nearby major background sources that would be expected to have a significant concentration gradient near the CCNPP. In the case of the NAAQS compliance analysis for non-PSD pollutants, the modeled impacts are also summed with representative background concentrations that account for distant or small local sources not explicitly modeled. The latest three years of background monitoring data was used. The representative monitoring location is plotted in Figure 5-5 and the monitored values are summarized in Table 5-3. The nearest available site of PM_{10} measurements is located in Virginia, about 66 km northwest of the CCNPP. The requirement for pre-construction PM_{10} monitoring can be waived because, as indicated below, the predicted project concentrations are below the pre-construction monitoring thresholds (de minimis concentrations) for PM_{10}. However, there is representative PM_{10} monitoring at the Mt. Vernon site for the purpose of identifying regional background concentrations.

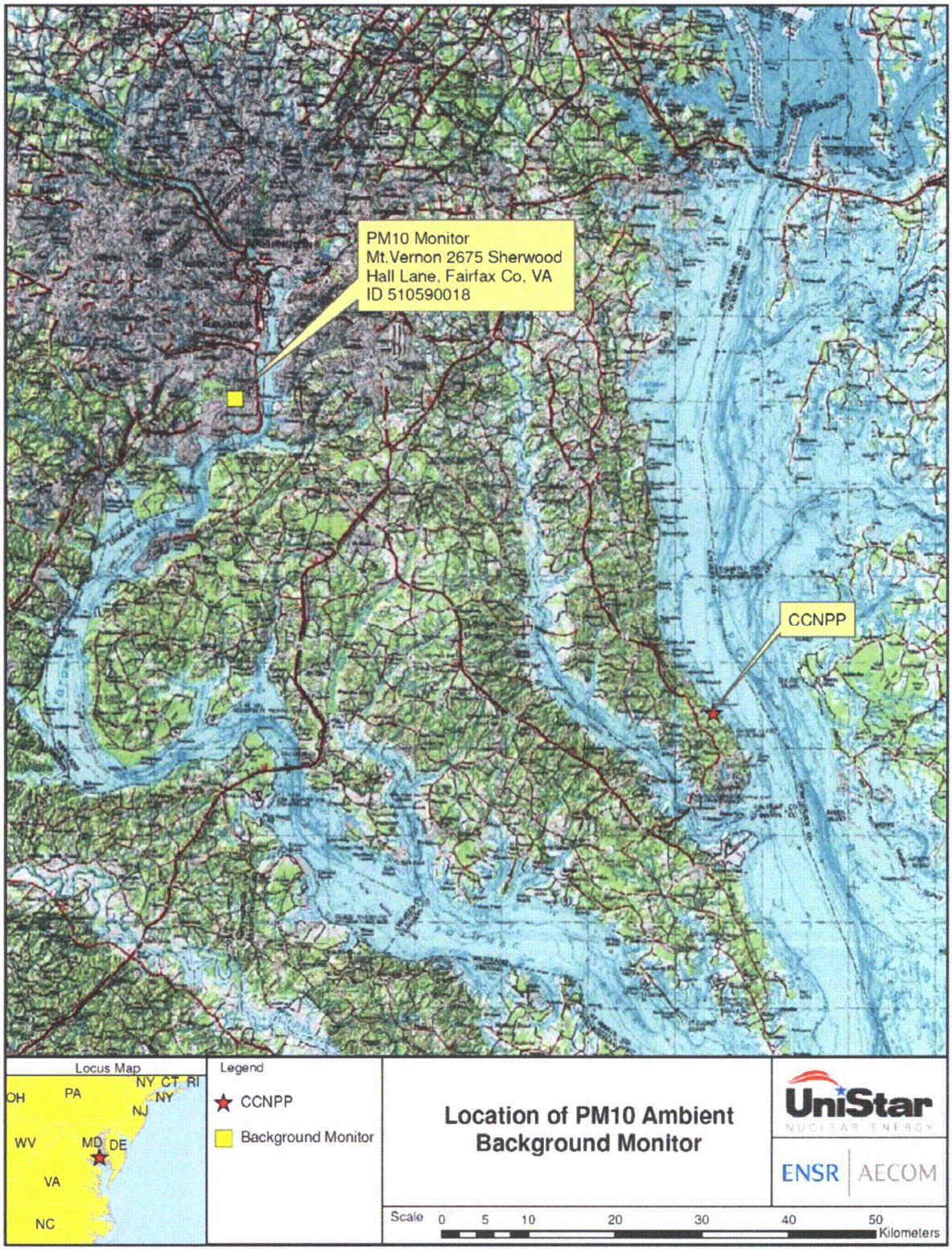
Table 5-2 Ambient Air Impact Criteria in μg/m³

Pollutant	Averaging Period	PSD Class II Significant Impact Levels	PSD Class II Increments	NAAQS	
				Primary	Secondary
NO_2	Annual	1	25	100	10 0
CO	1-hour	2,000	-	40,000	NA
	8-hour	500	-	10,000	NA
PM_{10}	24-hour	5	30	150	150
	Annual	1	17	50	50
SO_2	3-hour	25	512	NA	1300
	24-hour	5	91	365	NA
	Annual	1	20	80	NA

Table 5-3 Ambient Monitoring Background Concentrations

Pollutant	Averaging Period	Ranking	Year	Concentration (μg/m³)	Monitor ID	Monitor Address	County	State
PM_{10}	24-hour	H2H	2005	38.0	510590018	Mt.Vernon 2675 Sherwood Hall Lane	Fairfax Co	VA
		H2H	2006	40.0	510590018	Mt.Vernon 2675 Sherwood Hall Lane	Fairfax Co	VA
		H2H	2007	36.0	510590018	Mt.Vernon 2675 Sherwood Hall Lane	Fairfax Co	VA
		3-Year Average Value		**38.0**				
	Annual	H	2005	21.0	510590018	Mt.Vernon 2675 Sherwood Hall Lane	Fairfax Co	VA
		H	2006	21.0	510590018	Mt.Vernon 2675 Sherwood Hall Lane	Fairfax Co	VA
		H	2007	20.0	510590018	Mt.Vernon 2675 Sherwood Hall Lane	Fairfax Co	VA
		3-Year Average Value		**20.7**				

Figure 5-5 Location of the Ambient Background Monitor



6.0 PM_{10} Modeling Results for Proposed Unit 3 Emissions

The significant impact analysis for PM_{10} included sources associated with the operations of Unit 3. All of the peak impacts occurred close to the fenceline, within the 100-m spaced receptors shown in Figure 4-3. Therefore, no additional modeling was required to determine the peak impacts. The AERMOD modeling results of Unit 3 emission sources are summarized in Table 6-1.

6.1 Modeling Results for Significant Impact Area Determination

Modeling of PM_{10} short-term emission was conducted for the three normal operations cases and two backup power operations cases. These cases are described in Section 3.1. Results are presented in Table 6-1.

The maximum 24-hour modeled PM_{10} impact due to the normal operations (Case 3) was 4.4 µg/m^3, which is less than the Class II SIL of 5 µg/m^3. The maximum 24-hour modeled PM_{10} impact from the backup power operations (case 2) was 7.8 µg/m^3, which is above the Class II SIL of 5 µg/m^3. The impact occurred near the plant fenceline and the modeling resulted in an SIA extent of about 1.2 km from the CWS cooling tower. This extremely rare case is the only emission scenario that resulted in a significant modeled impact for PM_{10}.

The peak 24-hour modeled PM_{10} result is below the PSD pre-construction de minimis monitoring threshold of 10 µg/m^3. Therefore, UniStar concludes that no pre-construction monitoring is required for this PSD permit application.

The Unit 3 short-term peak PM_{10} emission modeling indicated that a cumulative analysis is required for 24-hour PM_{10}. The associated NAAQS and PSD increment analyses are described in Section 8.

The annual modeled PM_{10} impacts from the cooling tower, four EDGs and two SBOs resulted in concentrations of about 0.1 µg/m^3, which is below the SIL of 1.0 µg/m^3. As a result, no further analysis is required to show compliance with the annual PM_{10} NAAQS for the proposed project.

Table 6-1 PM_{10} Modeling Results of Unit 3 Emission Sources

Averaging Period	Operating Scenario	Modeled Sources	2001-2005 Max Modeled Concentration	Class II Significant Impact Level	NAAQS
			(µg/m^3)	(µg/m^3)	(µg/m^3)
24-hr	Normal Operations Case 1	CWS & ESWS	1.1	5	150
24-hr	Normal Operations Case 2	CWS & ESWS & 1 EDG Testing at 100% Load	2.9	5	150
24-hr	Normal Operations Case 3	CWS & ESWS & 1 SBO Testing for 12 hrs	4.4	5	150
24-hr	Backup Power Operations Case 1	ESWS & 4 EDGs at 70% Load for 1 hr & 2 EDGs at 70% Load for rest of period	3.3	5	150
24-hr	Backup Power Operations Case 2	ESWS & 2 SBOs for 8 hrs	7.8	5	150
Annual	Annual hours of operation	CWS & ESWS & 4 EDGs & 2 SBOs	0.1	1	50

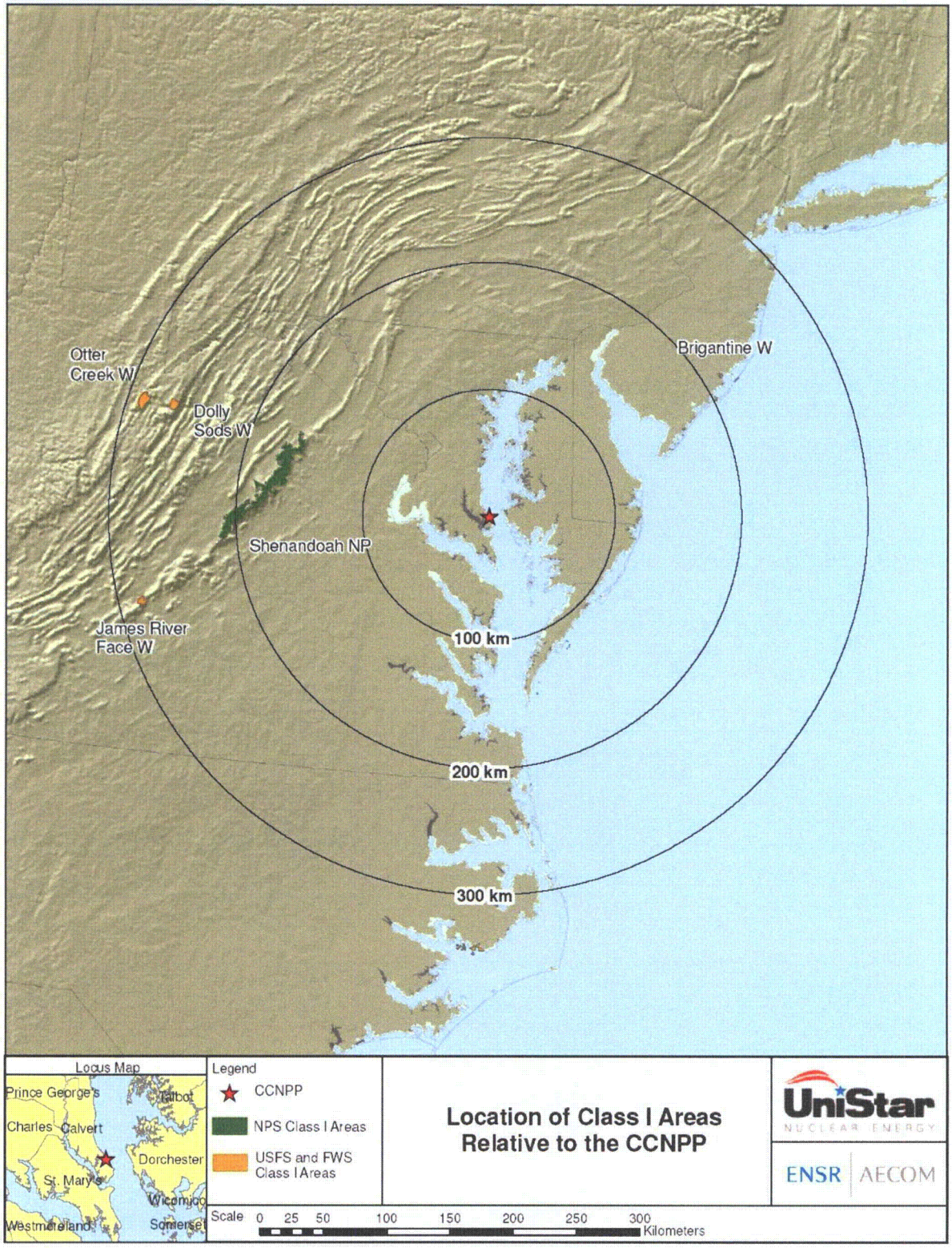
7.0 PSD Class I Modeling Analysis

Figure 7-1 shows all PSD Class I areas within 300 km of the proposed project site. There are five PSD Class I areas within 300 km. These Class I areas are under the jurisdiction of the National Park Service (one area), the Fish & Wildlife Service (one area), and the Forest Service (three areas).

The short-term PM_{10} emissions associated with the worst case being modeled are a total of 59.66 lb/hr, equivalent to about 261 TPY. The nearest Class I area, Shenandoah National Park, is about 160 km away from the CCNPP. The effective Q/D, where Q is the equivalent tons per year of emissions and D is the distance to the Class I area in km, is less than 2. Due to this low Q/D value, the applicant anticipates that modeling would show very low modeled impacts, and requested that the Federal Land Managers grant the project a waiver from conducting PSD Class I modeling for this application.

A request for a waiver of PSD Class I modeling requirements was granted by all three Federal Land Managers involved. Appendix B presents agency correspondence granting the requested waiver. Therefore, PSD Class I modeling was not conducted for this project.

Figure 7-1 PSD Class I Areas within 300 km of the CCNPP



8.0 Cumulative Modeling Analysis Results

The significant impact analysis of the project sources showed that the short-term PM_{10} impacts are above the SIL. Therefore, cumulative modeling is required to show compliance with the short-term PM_{10} NAAQS and PSD increments for the Unit 3 sources and any nearby major background sources. The modeled impacts for the NAAQS compliance test were also summed with representative background concentrations, listed in Table 5-3, that account for distant or small local sources not explicitly modeled.

8.1 NAAQS Compliance Modeling Results

For the NAAQS compliance, ENSR modeled short-term PM_{10} emissions from CCNPP Units 1 and 2 as well as from nearby background sources expected to cause a significant concentration gradient in the vicinity of the proposed project. An emission inventory of the PM_{10} emission sources throughout Virginia was recently provided by Mr. Michael Kiss of the Virginia Department of Environmental Protection for the Mirant Potomac Power Plant in Virginia. Mr. Kiss also provided an emission inventory for the District of Columbia (through Mr. Abraham Hagos of the Department of Health's Air Quality Division) and for Maryland (through Mr. Michael Woodman of MDE). ENSR considered all background sources within the SIA plus 50 kilometers as candidates for the cumulative modeling. ENSR applied a conservatively low Q/D (tons per year emissions divided by distance of the source from CCNPP in km) of 0.3 (instead of the often used North Carolina rule of 20) to eliminate sources that would not have an impact on the cumulative modeling. The factor of 0.3 is consistent with procedures recommended by Mr. Donald Shepherd of the National Park Service for determining a PSD increment inventory. Although a factor of 0.3 is lower (and more conservative) than the value used for other NAAQS modeling, we used it here for convenience so that the same inventory could be used for both the NAAQS and PSD increment cumulative modeling. For the NAAQS compliance modeling, the background sources eliminated from the modeling were presumed not to have a significant concentration gradient near the project source, and that their impact is accounted for in the conservatively high regional background concentration added to the total computed impact. Appendix C presents emissions and stack parameters of the sources that that were included in the cumulative modeling. Appendix C also presents a figure showing the locations of the background sources that were modeled.

The cumulative modeling results are presented in Table 8-1. The total short-term impacts were estimated by adding the highest, second-high impact of all sources modeled (resolved with additional receptor grids, where necessary, to a horizontal resolution of 100 m) to the background value. The short-term PM_{10} total modeled impacts are well below than their respective NAAQS, so compliance with the PM_{10} short-term NAAQS is demonstrated.

Table 8-1 NAAQS Compliance Modeling Results

Pollutant	Averaging Period	H2H 2001-2005 Modeled Concentration	Ambient Monitoring Background	Total	NAAQS
		($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
PM_{10}	24-hr	85.2	38	123.2	150

8.2 PSD Increment Compliance Modeling Results

For the PSD increment modeling, ENSR used the same background inventory discussed in Section 8.1. Only those combustion sources at the existing CCNPP Units 1 and 2 that were built after the major source baseline date of January 6, 1975 were included in the modeling. These sources, which are all backup power generators, would be unlikely to operate except for individual short testing periods. However, the modeling conservatively assumed continuous and simultaneous operation of these units for all five years modeled. For the rest of the background inventory, all sources used in the NAAQS modeling were assumed to consume increment – a very conservative assumption.

Several of the existing generator sources at Units 1 and 2 have horizontal stacks. The EPA treatment of these types of sources is that the vertical component of the momentum flux is essentially zero for modeling purposes, while the buoyancy flux is creditable in the modeling. This is accomplished in the modeling by adjusting (increasing) the input diameter while artificially setting the exit velocity to 0.001 m/s. However, for stacks affected by building downwash, it has been found that the diameter adjustment causes problems for the PRIME downwash algorithm in AERMOD. While the ultimate solution is for EPA to change the model code to separately set the momentum rise to zero and to fully credit the buoyancy rise, this change has not yet occurred. In the meantime, the AERMOD Implementation Guide (dated January 9, 2008) acknowledges that while it is normally intended that the buoyancy flux would be creditable, it cannot be done in the interim, and the result is a very conservative treatment of point sources with horizontal stacks that are affected by downwash, with effectively near-zero momentum and buoyancy fluxes. Therefore, the results presented here in Tables 8-1 and 8-2 are acknowledged by EPA to be overestimates.

The results of the PM_{10} short-term PSD increment modeling are presented in Table 8-2. These results indicate that the PSD increment consumption is below the limit of 30 $\mu g/m^3$, even with the conservative modeling treatment of horizontal stacks at Units 1 and 2 affected by building downwash.

Table 8-2 PSD Increment Compliance Modeling Results

Pollutant	Averaging Period	H2H 2001-2005 Modeled Concentration	PSD Class II
		($\mu g/m^3$)	($\mu g/m^3$)
PM_{10}	24-hr	26.4	30

9.0 Other Air Quality Impacts

9.1 Associated Growth

A growth analysis examines the potential emissions from secondary sources associated with the proposed project. While these activities are not directly involved in project operation, the emissions involve those that can reasonably be expected to occur; for instance, industrial, commercial, and residential growth that will occur in the project area due to the project itself. Secondary emissions do not include any emissions which come directly from a mobile source, such as emissions from the tailpipe of any on-road motor vehicle or the propulsion of a train (USEPA 1990). They also do not include sources that do not impact the same general area as the source under review. Due to the fact that the project site is not immediately adjacent to a labor force that would serve the plant or any facilities that would support a town, the emissions due to any residential growth will not impact the project area and will not be included in the growth analysis. The construction period will feature a transient work force that does not contribute substantially to long-term growth. The workforce for both construction and operation of the plant will be within commuting distance of the plant, but the air quality impacts due to this work force commuting will be distant from the project and spread out over a large area.

9.2 Soils and Vegetation

PSD regulations require an analysis of air quality impacts on sensitive vegetation types, with significant commercial or recreational value, and sensitive types of soil. The predicted impacts attributable to the proposed project are usually compared with the screening levels presented in *A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals* (USEPA 1980) (see **Table 9-1**). However,, since PM_{10} is not part of the evaluation of air quality impacts on soils and vegetation, this screening procedure does not apply in this case.

The Co-Applicants have conducted an extensive analysis of the impact of the cooling tower emissions, specifically salt deposition, on surrounding flora and fauna as part of the CPCN Technical Report filed with the PSC in November 2007.

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

Because the highest modeled salt deposition rate projected for the proposed cooling tower, 0.13 kg/hectare, is only about 2.5% of the injury threshold for the most sensitive species, no adverse impact on the vegetation in the area is expected due to the operation of Unit 3.

Table 9-1 Screening concentrations for soils and vegetation

Pollutant	Averaging Period	Screening Concentration ($\mu g/m^3$)
SO2	1-Hour	917
	3-Hour	786
	Annual	18
NO_2	4-Hours	3,760
	1-Month	564
	Annual	94
CO	Weekly	1,800,000

Source: "A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals". EPA 450/2-81-078, December 1980.

9.3 Ozone

Since projected NO_x and VOC are below 25 TPY, impacts of the project on ambient ozone do not need to be considered.

9.4 Visibility Impacts

The impacts of the cooling tower emissions on visibility in PSD Class I areas were not of concern to the Federal Land Managers, who granted a waiver for modeling of Air Quality Related Values and PSD increments (see Appendix B). Since the CWS cooling tower plume is not visible by the operation (when necessary) of the "dry section" that mitigates the water vapor plume, the only impact on local visibility would be due to salt particles emitted to the air by cooling tower. Since Chesapeake Bay is a large natural source of sea salt aerosol particles, this source of particles would not likely be distinguishable from natural aerosols that are already in the area. The PPRP and MDE have not identified any local scenic vistas that would require a local visibility modeling analysis for the impacts of the cooling tower emissions. Therefore, no additional visibility analysis was conducted for this project.

10.0 References

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Technical Report in Support of Application of UNISTAR Nuclear Energy, LLC and UNISTAR Nuclear Operating Services, LLC for Certificate of Public Convenience and Necessity Before the Maryland Public Service Commission for Authorization to Construct Unit 3 at Calvert Cliffs Nuclear Power Plant and Associated Transmission Lines. Available at http://webapp.psc.state.md.us/intranet/Casenum/submit.cfm?DirPath=C:\Casenum\9100-9199\9127\Item_001\&CaseN=9127\Item_001.

U.S. EPA 1980. A Screening Procedure for the Impacts of Air Pollution Sources on Plants, Soils, and Animals. EPA-450/2-81-078. Research Triangle Park, NC 27711.

U.S. EPA 1985. Guideline for Determination of Good Engineering Practice Stack Height. EPA Document No. EPA-450/4-80-023R. Office of Air Quality Planning and Standards, Research Triangle Park, NC. June.

U.S. EPA 1990. *New Source Review Workshop Manual, Prevention of Significant Deterioration and Nonattainment Area Permitting.* EPA Office of Air Quality Planning and Standards (OAQPS) RTP, NC 27711. Draft, October.

U.S. EPA 2004. User's Guide for the AERMOD Meteorological Processor (AERMET) EPA Document No. EPA-454/B-03-002. Office of Air Quality Planning and Standards, Research Triangle Park, NC. November.

U.S. EPA 2005a. Guideline on Air Quality Models (Revised). Codified in the Appendix W to 40 CFR Part 51. Office of Air Quality Planning and Standards, Research Triangle Park, NC. November.

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U.S. EPA 2008. AERMOD Implementation Guide. Office of Air Quality Planning and Standards, Research Triangle Park, NC. Revised January 9, 2008.

U.S. Nuclear Regulatory Commission, 1999. Generic Environmental Impact Statement for License Renewal of Nuclear Plant" (NUREG-1437), Supplement 1. Available at http://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1437/supplement1/, accessed March 2008.

U.S. Locations

AK, Anchorage
(907) 561-5700

AL, Birmingham
(205) 980-0054

AL, Florence
(256) 767-1210

CA, Alameda
(510) 748-6700

CA, Camarillo
(805) 388-3775

CA, Long Beach
(562) 420-2933

CA, Oakland
(805) 388-3775

CA, Orange
(510) 350-9981

CA, Sacramento
(916) 362-7100

CO, Ft.Collins
(970) 493-8878

CO, Ft.Collins Tox Lab.
(970) 416-0916

CO, Golden
(303) 271-2100

CT, New Haven
(203) 776-2358

CT, Stamford
(203) 323-6620

CT, Willington
(860) 429-5323

FL, St. Petersburg
(727) 577-5430

FL, Tallahassee
(850) 385-5006

GA, Atlanta
(770) 296-9300

GA, Norcross
(770) 381-1836

IL, Chicago
(773) 714-9900

IL, Collinsville
(618) 344-1545

IL, Warrenville
(630) 836-1700

IN, Indianapolis
(317) 735-3030

KS, Shawnee Mission
(913) 362-8444

LA, New Orleans
(504) 592-3559

MA, Harvard Air Lab.
(978) 772-2345

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(508) 888-3900

MA, Westford
(978) 589-3000

MA, Woods Hole
(508) 457-7900

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(406) 652-7481

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NC, Morrisville
(919) 651-5700

NC, Raleigh
(919) 872-6600

NH, Belmont
(603) 524-8866

NJ, Morristown
(973) 457-0809

NJ, Piscataway
(732) 981-0200

NV, Las Vegas
(702) 688-5620

NY, Albany
(518) 453-6444

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(607) 277-5716

NY, Nyack
(845) 348-1520

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(315) 432-0506

NY, Syracuse Air Lab.
(315) 432-0506

OH, Cincinnati
(513) 772-7800

OR, Hood River
(503) 260-3446

OR, Portland
(503) 251-0731

PA, Eagleville
(610) 650-8770

PA, Langhorne
(215) 757-4900

PA, Monroeville
(412) 380-0140

PA, Pittsburgh
(412) 261-2910

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(803) 216-0003

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(512) 330-0507

TX, Dallas
(972) 509-2250

TX, Houston
(713) 520-9900

TX, Plano
(972) 509-2250

TX, San Antonio
(210) 296-2125

TX, Van
(903) 963-7317

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(703) 682-5000

VA, Chesapeake
(757) 312-0063

VA, Glen Allen
(804) 290-7920

WA, Bellingham
(360) 647-0990

WA, Redmond
(425) 881-7700

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(206) 624-9349

WA, Vancouver
(360) 695-5706

WI, Milwaukee
(262) 523-2040

WY, Casper
(307) 261-4209

Headquarters
MA, Westford
(978) 589-3000

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Appendix A

MDE Permit Application Forms

MARYLAND DEPARTMENT OF THE ENVIRONMENT

1800 Washington Blvd ▪ Baltimore, Maryland 21230
(410) 537-3230 ▪1-800-633-6101 ▪ www.mde.state.md.us

Air and Radiation Management Administration ▪ Air Quality Permits Program

APPLICATION FOR PROCESSING/MANUFACTURING EQUIPMENT

Permit to Construct ❑ Registration Update ❑ Initial Registration ❑

1A. Owner of Equipment/Company Name

UnitStar Nuclear Operating Service, LLC

Mailing Address

750 East Pratt Street
Street Address

Baltimore | MD | 21202
City | State | Zip

Telephone Number

(410) 470-5518

Signature

DO NOT WRITE IN THIS BLOCK
2. REGISTRATION NUMBER

County No. (1-2) | Premises No. (3-6)
Registration Class (7) | Equipment No. (8-11)
Data Year (12-13) | Application Date

Tom Roberts, VP Calvert Cliffs Nuclear Power Plant New Generation Project
Print Name and Title | Date

1B. Equipment Location and Telephone Number (if different from above)

1650 Calvert Cliffs Parkway
Street Number and Street Name

Lusby | MD | 20657 | (410) 495-4600
City/Town | State | Zip | Telephone Number

Premises Name (if different from above)

3. Status (A= New, B= Modification to Existing Equipment, C= Existing Equipment)

Status (15)	New Construction Begun (MM/YY) (16-19)	New Construction Completed (MM/YY) (20-23)	Existing Initial Operation (MM/YY) (20-23)
A	0411	0815	

4. Describe this Equipment: Make, Model, Features, Manufacturer (include Maximum Hourly Input Rate, etc.)

Cooling Water System (CWS) - Cooling Tower - See Section 4.2 of PSD Technical Support Document

5. Workmen's Compensation Coverage To be determined
Binder/Policy Number | Expiration Date

Company To be determined

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6A. Number of Pieces of Identical Equipment Units to be Registered/Permitted at this Time 1

6B. Number of Stack/Emission Points Associated with this Equipment 1

7. Person Installing this Equipment (if different from Number 1 on Page 1)

Name _____ Title _____

Company _____

Mailing Address/Street _____

City/Town _____ State _____ Telephone (_____) _____

8. Major Activity, Product or Service of Company at this Location

Electric power generation

9. Control Devices Associated with this Equipment

None [ ] 24-0

Simple/Multiple Cyclone	Spray/Adsorb Tower	Venturi Scrubber	Carbon Adsorber	Electrostatic Precipitator	Baghouse	Thermal/Catalytic Afterburner	Dry Scrubber
[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
24-1	24-2	24-3	24-4	24-5	24-6	24-7	24-8

Other

[X] Describe Drift/mist eliminators

24-9

10. Annual Fuel Consumption for this Equipment

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS _____ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED _____ (Specify Units of Measure)

OTHER FUEL _____ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED _____ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this Equipment)

Continuous Operation	Batch Process	Hours per Batch	Batch per Week	Hours per Day	Days Per Week	Days per Year
X				2 4	7	3 6 5
67-1	67-2	68-69		70-71	72	73-75

Seasonal Variation in Operation:

No Variation	Winter Percent	Spring Percent	Summer Percent	Fall Percent	(Total Seasons= 100%)
X					
76	77-78	79-80	81-82	83-84	

12. Equivalent Stack Innformation- is Exhaust through Doors, Windows, etc. Only? (Y/N) N

85

Temperature is variable
see Figure 3-1 in PSD TSD

If not, then	Height Avove Ground (FT)	Inside Diameter at Top	Exit Temperature (°F)	Exit Velocity (FT/SEC)
	164	344	77	21
	86-88	89-91	92-95	96-98

NOTE:
Attach a block diagram of process/process line, indicating new equipment as reported on this form and all existing equipment, including control devices and emission points.

13. Input Materials (for this equipment only)
Is any of this data to be considered confidential? N (Y or N)

NAME	CAS NO. (IF APPLICABLE)	INPUT RATE PER HOUR	UNITS	PER YEAR	UNITS
1. Sodium Bisulfite		21.9	pounds	191,500	pounds
2. Sodium Hypochlorite		62.5	gallons	547,500	gallons
3. Antifoam		2.1	gallons	18,250	gallons
4. Dispersant		43.7	pounds	383,000	pounds
5. Circulating Water		47 x 10^6	gallons	4.1 x 10^11	gallons
6.					
7.					
8.					
9.					
TOTAL					

14. Output Materials (for this equipment)
Process/Product Stream

NAME	CAS NO. (IF APPLICABLE)	OUTPUT RATE PER HOUR	UNITS	PER YEAR	UNITS
1. Circulating Water		47 x 10^6	gallons	4.1 x 10^11	gallons
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
TOTAL					

15. Waste Streams- Solid and Liquid

NAME	CAS NO. (IF APPLICABLE)	OUTPUT RATE PER HOUR	UNITS	PER YEAR	UNITS
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
TOTAL					

16. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day

Particulate Matter	Oxides of Sulfur	Oxides of Nitrogen
1 6 7 8	0	0
99-104	105-110	111-116

Carbon Monoxide	Volatile Organic Compounds	PM-10
0	0	1 3 4 3
177-122	123-128	129-134

17. Total Fugitive Emissions (for this equipment only) in Pounds Per Operating Day

Particulate Matter	Oxides of Sulfur	Oxides of Nitrogen
135-139	140-144	145-149

Carbon Monoxide	Volatile Organic Compounds	PM-10
150-154	155-159	160-164

Method Used to Determine Emissions **(1= Estimate 2= Emission Factor 3= Stack Test 4= Other)**

TSP	SOX	NOX	CO	VOC	PM10
1	1	1	1	1	1
165	166	167	168	169	170

AIR AND RADIATION MANAGEMENT ADMINISTRATION USE ONLY

18. Date Rec'd. Local _____ **Date Rec'd. State** _____ **Return to Local Jurisdiction** Date_____ By_____

Reviewed by Local Jurisdiction Date_____ By_____ **Reviewed by State** Date_____ By_____

19. Inventory Date **Month/Year** (171-174) **Equipment Code** (175-177) **SCC Code** (178-185)

20. **Annual Operating Rate** (186-192) **Maximum Design Hourly Rate** (193-199) **Permit to Operate Month** (200-201) **Transaction Date (MM/DD/YR)** (202-207)

Staff Code (208-210) **VOC Code** (211 212) **SIP Code** (213 214) **Regulation Code** (215-218) **Confidentiality** (219)

Point Description (220-238) **Action** (239) A: Add C: Change

MARYLAND DEPARTMENT OF THE ENVIRONMENT

1800 Washington Blvd ▪ Baltimore, Maryland 21230
(410) 537-3230 ▪1-800-633-6101 ▪ www.mde.state.md.us

Air and Radiation Management Administration ▪ Air Quality Permits Program

APPLICATION FOR PROCESSING/MANUFACTURING EQUIPMENT

Permit to Construct ❑ Registration Update ❑ Initial Registration ❑

1A. Owner of Equipment/Company Name

UnitStar Nuclear Operating Service, LLC

Mailing Address

750 East Pratt Street
Street Address

Baltimore | MD | 21202
City | State | Zip

Telephone Number

(410) 470-5518

Signature

DO NOT WRITE IN THIS BLOCK
2. REGISTRATION NUMBER

County No. (1-2) | Premises No. (3-6)
Registration Class (7) | Equipment No. (8-11)
Data Year (12-13) | Application Date

Tom Roberts, VP Calvert Cliffs Nuclear Power Plant New Generation Project
Print Name and Title | Date

1B. Equipment Location and Telephone Number (if different from above)

1650 Calvert Cliffs Parkway
Street Number and Street Name

Lusby | MD | 20657 | (410) 495-4600
City/Town | State | Zip | Telephone Number

Premises Name (if different from above)

3. Status (A= New, B= Modification to Existing Equipment, C= Existing Equipment)

Status (15)	New Construction Begun (MM/YY) (16-19)	New Construction Completed (MM/YY) (20-23)	Existing Initial Operation (MM/YY) (20-23)
A	0411	0815	

4. Describe this Equipment: Make, Model, Features, Manufacturer (include Maximum Hourly Input Rate, etc.)
Essential Service Water System (ESWS) Cooling Towers (4) - See Section 4.2 of PSD Technical Support Document

5. Workmen's Compensation Coverage To be determined
Binder/Policy Number | Expiration Date

Company To be determined

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6A. Number of Pieces of Identical Equipment Units to be Registered/Permitted at this Time 4

6B. Number of Stack/Emission Points Associated with this Equipment 4

7. Person Installing this Equipment (if different from Number 1 on Page 1)

Name_____ Title_____

Company_____

Mailing Address/Street_____

City/Town_____ State_____ Telephone (_____) _____

8. Major Activity, Product or Service of Company at this Location

Electric power generation

9. Control Devices Associated with this Equipment

None [ ] 24-0

Simple/Multiple Cyclone	Spray/Adsorb Tower	Venturi Scrubber	Carbon Adsorber	Electrostatic Precipitator	Baghouse	Thermal/Catalytic Afterburner	Dry Scrubber
[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]	[ ]
24-1	24-2	24-3	24-4	24-5	24-6	24-7	24-8

Other

[X] Describe Drift/mist eliminators

24-9

10. Annual Fuel Consumption for this Equipment

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS _____ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED _____ (Specify Units of Measure)

OTHER FUEL _____ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED _____ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this Equipment)

Continuous Operation	Batch Process	Hours per Batch	Batch per Week	Hours per Day	Days Per Week	Days per Year
X				24	7	365
67-1	67-2	68-69		70-71	72	73-75

Seasonal Variation in Operation:

No Variation	Winter Percent	Spring Percent	Summer Percent	Fall Percent
X				
76	77-78	79-80	81-82	83-84

(Total Seasons= 100%)

12. Equivalent Stack Innformation- is Exhaust through Doors, Windows, etc. Only? (Y/N) N (85)

If not, then	Height Avove Ground (FT)	Inside Diameter at Top	Exit Temperature (°F)	Exit Velocity (FT/SEC)
	106	68	77	6
	86-88	89-91	92-95	96-98

NOTE:
Attach a block diagram of process/process line, indicating new equipment as reported on this form and all existing equipment, including control devices and emission points.

13. Input Materials (for this equipment only)
Is any of this data to be considered confidential? N (Y or N)

NAME	CAS NO. (IF APPLICABLE)	INPUT RATE (per unit) PER HOUR	UNITS	PER YEAR	UNITS
1. Sodium Hypochlorite &		0.46	gallons	4,030	gallons
2. Surfactant					
3. Circulating Water		1.14 x 10^6	gallons	1.0 x 10^10	gallons
4.					
5.					
6.					
7.					
8.					
9.					
TOTAL					

14. Output Materials (for this equipment)
Process/Product Stream

NAME	CAS NO. (IF APPLICABLE)	OUTPUT RATE (per unit) PER HOUR	UNITS	PER YEAR	UNITS
1. Circulating Water		1.14 x 10^6	gallons	1.0 x 10^10	gallons
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
TOTAL					

15. Waste Streams- Solid and Liquid

NAME	CAS NO. (IF APPLICABLE)	OUTPUT RATE PER HOUR	UNITS	PER YEAR	UNITS
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
9.					
TOTAL					

16. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day
(per unit)

Particulate Matter	Oxides of Sulfur	Oxides of Nitrogen
9	0	0
99-104	105-110	111-116

Carbon Monoxide	Volatile Organic Compounds	PM-10
0	0	8
177-122	123-128	129-134

17. Total Fugitive Emissions (for this equipment only) in Pounds Per Operating Day

Particulate Matter	Oxides of Sulfur	Oxides of Nitrogen
135-139	140-144	145-149

Carbon Monoxide	Volatile Organic Compounds	PM-10
150-154	155-159	160-164

Method Used to Determine Emissions **(1= Estimate 2= Emission Factor 3= Stack Test 4= Other)**

TSP	SOX	NOX	CO	VOC	PM10
1	1	1	1	1	1
165	166	167	168	169	170

AIR AND RADIATION MANAGEMENT ADMINISTRATION USE ONLY

18. Date Rec'd. Local _____ **Date Rec'd. State** _____ **Return to Local Jurisdiction** Date_____ By_____

Reviewed by Local Jurisdiction Date_____ By_____ **Reviewed by State** Date_____ By_____

19. Inventory Date **Month/Year** (171-174) **Equipment Code** (175-177) **SCC Code** (178-185)

20. **Annual Operating Rate** (186-192) **Maximum Design Hourly Rate** (193-199) **Permit to Operate Month** (200-201) **Transaction Date (MM/DD/YR)** (202-207)

Staff Code (208-210) **VOC Code** (211 212) **SIP Code** (213 214) **Regulation Code** (215-218) **Confidentiality** (219)

Point Description (220-238) **Action** (239) A: Add C: Change

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SUMMARY OF DEMONSTRATIONS FOR MEETING THE AMBIENT IMPACT REQUIREMENT (26.11.15.05) AND THE T-BACT REQUIREMENT (26.11.15.06)

DO NOT WRITE IN THIS SPACE

Company Name UniStar Nuclear Operating Services, LLC

1. Summary of T-BACT Demonstration: List all emission reduction options considered in determining T-BACT starting with the option that reduces emissions the most. Supporting documentation **must** be attached.

Emission Reduction Option	% Emission Reduction	COSTS Capital	COSTS Annual Operating
1. Drift Mist Eliminator (CWS-1)	99.9995		
Drift Eliminator Efficency of 99.9995% represents the top level of control, no other options were considered. (See section 4.0 of PSD Technical Support Document.)			
2. Drift Mist Eliminator (ESWS)	99.995		
No other options were considered for ESWS as 99.995% reduction results in negligible emissions.			
3.			
4.			
5.			

2. Identify the emission reduction option selected as T-BACT and briefly explain why this is the best selection. Supporting documentation **must** be attached.

These additives to the cooling water will be removed along with other fine particulates by the drift mist eliminators which are highly efficient. Supporting documentation is included with the cooling tower calculations for this source.

3. List screening levels and highest estimated off-site concentrations (ug/m^3) resulting from **premises-wide allowable emissions** (1) of each Toxic Air Pollutant that is covered by the regulations and discharged fromthe installation or source applying for the permit. See the General Instructions for more detail. Supporting documentation **must** be attached.

	Toxic Air Pollutant	CAS Number	SCREENING LEVEL(S) 1-HR	SCREENING LEVEL(S) 8-HR	SCREENING LEVEL(S) Annual	OFF-SITE CONCENTRATIONS 1-HR	OFF-SITE CONCENTRATIONS 8-HR	OFF-SITE CONCENTRATIONS Annual
1	Sodium Hypochlorite	7681-52-9		81.2			3.83E-05	
2	Sodium Hydroxide	1310-73-2	20			3.78E-05		
3	HEDP	2809-21-4		82			1.30E-05	
4	Petroleum Distillates	64741-44-2		170			4.12E-06	
5								
6								
7								
8								
9								
10								
11								
12								
13								
14								
15								
16								

☐ If unable to use a Screening Analysis, check the box and attach the Second Tier Analysis or Special Permit request to this form.

(1) **Premises** is defined as: "all the installations or other sources that are located on contiguous or adjacent properties and that are under the control of one person or under common control of a group of persons" (COMAR 26.11.15.01B(12)).

Allowable Emissions are defined as: "the maximum emissions a source or installation is capable of discharging after consideration of any physical or operational limitations required by this subtitle or by enforceable conditions included in an applicable air quality permit to construct, permit to operate, secretarial order, plan for compliance, consent agreement, or court order" (COMAR 26.11.15.01B(2)).

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EMISSIONS DATA

Fill out one Form 5B for each stack or other emission point subject to the regulations (see the General Instructions for more detail).

Company Name UniStar Nuclear Operating Services, LLC

1. Number Identifying this Emission Point on Required Plot Plan CWS-1
   (If applicable, list company's internal I.D. _____)

2. Brief description of Emission Point, Associated Equipment and Control Devices

   Circulating Water System Cooling Tower

3. Emission Schedule (for this stack or emission point)

Continuous	Intermittent	Minutes/Hour	Hours/Day	Days/Week	Weeks/Year
X					

Seasonal Variation: None X Winter %_____ Spring%_____ Summer%_____ Fall%_____

4. Stack Information

Temp is variable see Fig. 3-1 in PSD TSD

Height above ground (ft): 164
Inside Diameter at top of round stack (ft): 344
Exit Temperature (°F): 77
Height above structures (ft): 164
Dimensions at top of rectangular stack (ft): _____
Exit Velocity (ft/min) (See Note): 1281
Distance to Nearest Property Line (ft): 2,638 to Northeast
Gas Volume (acfm): 119,600,000

Dimensions of Building Stack is on (ft): Height_____ Length_____ Width_____

Note: Air dispersion modeling was based on wet section operation only.
Exit velocity: 715 ft/min - Gas Flow Volume: 66,454,900 acfm (See Technical Support Document)

5. Control Devices Associated with this Stack or Emission Point

Control Device	Number	Control Device	Number
0. None		7. Elec. Precipitator	
1. Simple Cyclone		8. Baghouse	
2. Multiple Cyclone		9. Thermal Afterburner	
3. Spray Tower		10. Catalytic Afterburner	
4. Absorption Tower		11. Other (specify)	
5. Venturi Scrubber		Drift Mist Eliminator 99.9995%	
6. Carbon Adsorber			

6. Criteria Pollutant Emissions (attach supporting documentation)

Criteria Pollutants	ESTIMATED EMISSIONS Design Capacity (lb/hr)	Projected (lb/hr)	Operations (1) (ton/year)
Particulate Matter	69.93	69.93	306.28
PM10	55.94	55.94	245.03
Oxides of Sulfur			
Oxides of Nitrogen			
Carbon Monoxide			
VOC (total)			
Lead			

7. Toxic Air Pollutant Emissions (attach supporting documentation)

		ESTIMATED EMISSIONS				
		Design Capacity	Projected Operations (1)		Used for Form 5A, Part 3 (2)	
Toxic Air Pollutant (list all)	CAS Number	(lb/hr)	(lb/hour)	(ton/year)	(lb/hour)	(ton/year)
1. Sodium Hypochlorite	7681-52-9	0.002	0.002	0.010	0.002	0.010
2. Sodium Hydroxide	1310-73-2	0.006	0.006	0.03	0.006	0.03
3. HEDP	2809-21	0.002	0.002	0.01	0.002	0.01
4. Petroleum Distillates	64741-44-2	0.003	0.003	0.01	0.003	0.01
5.						
6.						
7.						
8.						
9.						

(1) Based on the emission schedule reported in Block three of this form.
(2) This column must be filled in with the emission estimates used to demonstrate compliance with the regulations. If continuous emissions at design capacity allow you to demonstrate compliance with all air pollution regulations, then these emissions should be listed here. If the air toxic regulations or any other regulations require you to discharge less than continuously at design capacity, then these emissions should be listed here.

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EMISSIONS DATA

Fill out one Form 5B for each stack or other emission point subject to the regulations (see the General Instructions for more detail).

Company Name UniStar Nuclear Operating Services, LLC

1. Number Identifying this Emission Point on Required Plot Plan ESWS -1, -2, -3, -4
   (If applicable, list company's internal I.D. _____)

2. Brief description of Emission Point, Associated Equipment and Control Devices

   Essential Service Water System Cooling Towers

3. Emission Schedule (for this stack or emission point)

Continuous	Intermittent	Minutes/Hour	Hours/Day	Days/Week	Weeks/Year
x					

Seasonal Variation: None x Winter %_____ Spring%_____ Summer%_____ Fall%_____

4. Stack Information

Height above ground (ft): 106
Inside Diameter at top of round stack (ft): 68
Exit Temperature (°F): 77
Height above structures (ft): 106
Dimensions at top of rectangular stack (ft): _____
Exit Velocity (ft/min): 334
Distance to Nearest Property Line (ft): 1,350 to Northeast
Gas Volume (acfm): 1,100,000

Dimensions of Building Stack is on (ft): Height_____ Length_____ Width_____

5. Control Devices Associated with this Stack or Emission Point

Control Device	Number	Control Device	Number
0. None		7. Elec. Precipitator	
1. Simple Cyclone		8. Baghouse	
2. Multiple Cyclone		9. Thermal Afterburner	
3. Spray Tower		10. Catalytic Afterburner	
4. Absorption Tower		11. Other (specify)	
5. Venturi Scrubber		Drift Mist Eliminator 99.995%	
6. Carbon Adsorber			

6. Criteria Pollutant Emissions (attach supporting documentation) (Four units)

Criteria Pollutants	ESTIMATED EMISSIONS Design Capacity (lb/hr)	Projected (lb/hr)	Operations (1) (ton/year)
Particulate Matter	1.42	1.42	6.21
PM10	1.32	1.32	5.78
Oxides of Sulfur			
Oxides of Nitrogen			
Carbon Monoxide			
VOC (total)			
Lead			

7. Toxic Air Pollutant Emissions (attach supporting documentation) design capacity and projected operations reflect all 4 ESWS units, Form 5A Part 3 reflects 2 ESWS units in actual operation.

		ESTIMATED EMISSIONS Design Capacity	Projected Operations (1)		Used for Form 5A, Part 3 (2)	
Toxic Air Pollutant (list all)	CAS Number	(lb/hr)	(lb/hour)	(ton/year)	(lb/hour)	(ton/year)
1. Sodium Hypochlorite	7681-52-9	0.0001	0.0001	0.0004	0.00005	0.0002
2. Sodium Hydroxide	1310-73-2	0.0002	0.0002	0.002	0.0001	0.001
3.						
4.						
5.						
6.						
7.						
8.						
9.						

(1) Based on the emission schedule reported in Block three of this form.
(2) This column must be filled in with the emission estimates used to demonstrate compliance with the regulations. If continuous emissions at design capacity allow you to demonstrate compliance with all air pollution regulations, then these emissions should be listed here. If the air toxic regulations or any other regulations require you to discharge less than continuously at design capacity, then these emissions should be listed here.

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APPLICATION FOR PERMIT TO CONSTRUCT
GAS CLEANING OR EMISSION CONTROL EQUIPMENT

1. Owner of Installation: UniStar Nuclear Operating Services, LLC
Telephone No.: (410) 470-5518
Date of Application:

2. Mailing Address: 750 East Pratt Street
City: Baltimore
Zip Code: 21202
County: Baltimore

3. Equipment Location: 1650 Calvert Cliffs Parkway
City/Town or P.O.: Lusby
County: Calvert

4. Signature of Owner or Operator:
Title: Tom Roberts, VP Calvert Cliffs Nuclear Power Plant New Generation Project
Print or Type Name:

5. Application Type: Alteration [ ] New Construction [X]

6. Date Construction is to Start: April 2011
Completion Date (Estimate): August 2015

7. Type of Gas Cleaning or Emission Control Equipment:

Simple Cyclone [ ] Multiple Cyclone [ ] Afterburner [ ] Electrostatic Precipitator [ ]

Scrubber [ ] _____ (type) Other [X] Drift Mist Eliminator (type)

8. Gas Cleaning Equipment Manufacturer: To Be Determined
Model No.:
Collection Efficiency (Design Criteria): 99.9995%

9. Type of Equipment which Control Equipment is to Service:

Circulating Water System (CWS) Cooling Tower

10. Stack Test to be Conducted:

Yes [ ] No [X] _____ (Stack Test to be Conducted By) _____ (Date)

11. Cost of Equipment _____

Estimated Erection Cost _____

12. The Following Shall Be Design Criteria:

	INLET		OUTLET	
Gas Flow Rate	119,600,000	ACFM* (See Note)	119,600,000	ACFM* (See Note)
Gas Temperature	77	°F (temp variable see Fig. 3-1 in PSD technical support document)	77	°F
Gas Pressure		INCHES W.G.		INCHES W.G.
PRESSURE DROP				
Dust Loading		GRAINS/ACFD**		GRAINS/ACFD**
Moisture Content OR		%		%
Wet Bulb Temperature		°F		°F
Liquid Flow Rate (Wet Scrubber)		GALLONS/MINUTE		

(WHEN SCRUBBER LIQUID OTHER THAN WATER INDICATE COMPOSITION OF SCRUBBING MEDIUM IN WEIGHT %)

*= ACTUAL CUBIC FEET PER MINUTE **= ACTUAL CUBIC FEET DRY

Note: Air dispersion modeling was based on wet section operation only.

Exit velocity: 715 ft/min - Gas Flow Volume: 66,454,900 acfm (See Technical Support Document)

WHEN APPLICATION INVOLVES THE REDUCTION OF GASEOUS POLLUTANTS, PROVIDE THE CONCENTRATION OF EACH POLLUTANT IN THE GAS STREAM IN VOLUME PERCENT. INCLUDE THE COMPOSITION OF THE GASES ENTERING THE CLEANING DEVICE AND THE COMPOSITION OF EXHAUSTED GASES BEING DISCHARGED INTO THE ATMOSPHERE. USE AVAILABLE SPACE IN ITEM 15 ON PAGE 3.

13. Particle Size Analysis

see Table 3-1 in PSD TSD for technical reference

Size of Dust Particles Entering Cleaning Unit	% of Total Dust	% to be Collected
0 to 10 Microns	80	99.9995
10 to 44 Microns	20	99.9995
Larger than 44 Microns		

14. For Afterburner Construction Only:

Volume of Contaminated Air _____ CFM (DO NOT INCLUDE COMBUSTION AIR)

Gas Inlet Temperature _____ °F

Capacity of Afterburner _____ BTU/HR

Diameter (or area) of Afterburner Throat _____

Combustion Chamber _____ (diameter) _____ (length) Operating Temperature at Afterburner _____ °F

Retention Time of Gases _____

15. Show Location of Dust Cleaning Equipment in the System. Draw or Sketch Flow Diagram Showing Emission Path from Source to Exhaust Point to Atmosphere.

See Figure 6.5-1 (Rev 1), of schematic of CWS Cooling Tower in amended CPCN Technical Report.

Date Received: Local _____ _____ **State** _____

Acknowledgement Date: _____

By _____

Reviewed By:

Local _____

State _____

Returned to Local:

Date_____

By _____

Application Returned to Applicant:

Date_____

By _____

REGISTRATION NUMBER OF ASSOCIATED EQUIPMENT: ☐ ☐☐☐☐

PREMISES NUMBER: ☐☐ ☐☐☐☐

Emission Calculations Revised By _____ **Date** _____

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Air and Radiation Management Administration ▪ Air Quality Permits Program

APPLICATION FOR PERMIT TO CONSTRUCT
GAS CLEANING OR EMISSION CONTROL EQUIPMENT

1. Owner of Installation UniStar Nuclear Operating Services, LLC	**Telephone No.** (410) 470-5518		**Date of Application**
2. Mailing Address 750 East Pratt Street	**City** Baltimore	**Zip Code** 21202	**County** Baltimore
3. Equipment Location 1650 Calvert Cliffs Parkway	**City/Town or P.O.** Lusby		**County** Calvert
4. Signature of Owner or Operator	**Title** Tom Roberts, VP Calvert Cliffs Nuclear Power Plant New Generation Project		**Print or Type Name**

5. Application Type: Alteration [ ] New Construction [X]

6. Date Construction is to Start: April 2011 **Completion Date (Estimate):** August 2015

7. Type of Gas Cleaning or Emission Control Equipment:

Simple Cyclone [ ] Multiple Cyclone [ ] Afterburner [ ] Electrostatic Precipitator [ ]

Scrubber [ ] _____ (type) Other [X] Drift Mist Eliminator (type)

8. Gas Cleaning Equipment Manufacturer To Be Determined	**Model No.**	**Collection Efficiency (Design Criteria)** 99.995%

9. Type of Equipment which Control Equipment is to Service:

Essential Service Water System (ESWS) Cooling Towers

10. Stack Test to be Conducted:

Yes [ ] No [X] _____ (Stack Test to be Conducted By) _____ (Date)

11. Cost of Equipment _____

Estimated Erection Cost _____

Form number: 6
Revision date: 0/2000
TTY Users 1-800-735-2258

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12. The Following Shall Be Design Criteria:

	INLET		OUTLET	
Gas Flow Rate	1,100,000	ACFM*	1,100,000	ACFM*
Gas Temperature	77	°F	77	°F
Gas Pressure		INCHES W.G.		INCHES W.G.
	PRESSURE DROP			
Dust Loading		GRAINS/ACFD**		GRAINS/ACFD**
Moisture Content OR		%		%
Wet Bulb Temperature		°F		°F
Liquid Flow Rate (Wet Scrubber)		GALLONS/MINUTE		

(WHEN SCRUBBER LIQUID OTHER THAN WATER INDICATE COMPOSITION OF SCRUBBING MEDIUM IN WEIGHT %)

*= ACTUAL CUBIC FEET PER MINUTE **= ACTUAL CUBIC FEET DRY

WHEN APPLICATION INVOLVES THE REDUCTION OF GASEOUS POLLUTANTS, PROVIDE THE CONCENTRATION OF EACH POLLUTANT IN THE GAS STREAM IN VOLUME PERCENT. INCLUDE THE COMPOSITION OF THE GASES ENTERING THE CLEANING DEVICE AND THE COMPOSITION OF EXHAUSTED GASES BEING DISCHARGED INTO THE ATMOSPHERE. USE AVAILABLE SPACE IN ITEM 15 ON PAGE 3.

See Table 3-1 in PSD TSD for technical reference

13. Particle Size Analysis

Size of Dust Particles Entering Cleaning Unit	% of Total Dust	% to be Collected
0 to 10 Microns	93	99.995
10 to 44 Microns	7	99.995
Larger than 44 Microns		

14. For Afterburner Construction Only:

Volume of Contaminated Air _____ CFM (DO NOT INCLUDE COMBUSTION AIR)

Gas Inlet Temperature _____ °F

Capacity of Afterburner _____ BTU/HR

Diameter (or area) of Afterburner Throat _____

Combustion Chamber _____ (diameter) _____ (length) Operating Temperature at Afterburner _____ °F

Retention Time of Gases _____

15. Show Location of Dust Cleaning Equipment in the System. Draw or Sketch Flow Diagram Showing Emission Path from Source to Exhaust Point to Atmosphere.

Date Received: Local _____ **State** _____

Acknowledgement Date: _____

By _____

Reviewed By:

Local _____

State _____

Returned to Local:

Date_____

By _____

Application Returned to Applicant:

Date_____

By _____

REGISTRATION NUMBER OF ASSOCIATED EQUIPMENT: ☐ ☐☐☐☐

PREMISES NUMBER: ☐☐ ☐☐☐☐

Emission Calculations Revised By _____ **Date** _____

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APPLICATION FOR FUEL BURNING EQUIPMENT

Permit to Construct ☒ Registration Update ☐ Initial Registration ☐

1A. Owner of Equipment/Company Name
UniStar Nuclear Operating Services, LLC

Mailing Address/Street
750 East Pratt Street

City: Baltimore State: MD Zip Code: 21202

Telephone Number (410) 470-5518

Print Name/Title
Tom Roberts, VP Calvert Cliffs Nuclear Power Plant New Generation Project

Signature: Date:

DO NOT WRITE IN THIS BOX

2. Registration Number

County No. (1-2) Premises No. (3-6)

Registration Class (7) Equipment No. (6-11)

Data Year (12-13) Application Date

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):
1650 Calvert Cliffs Parkway, Lusby, MD 20657 (410) 495-4600

Premises Name (if different from above):

3. Status

A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A	0411	0815	
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
Four identical emergency diesel generators, each with a 10,130 kWe rating. (EDG 1-4)

5. Workmen's Compensation Coverage: Binder/Policy Number: To be determined

Company Name: _____ Expiration Date _____

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 4

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number): N/A

8. Major Activity, Product or Service of Company at this Location:
Electric power generation

9. Control Devices Associated with this Equipment

None ☐ (24-0) Simple/Multiple Cyclones ☐ (24-1) Spray/Adsorb Tower ☐ (24-2) Venturi Scrubber ☐ (24-3) Carbon Adsorber ☐ (24-4) Electrostatic Precipitator ☐ (24-5) Bag-house ☐ (24-6)

Thermal/Catalytic Afterburner ☐ (24-7) Dry Scrubber ☐ (24-8) Other ☐ (24-9) Describe _____

10. Annual Fuel Consumption for this Equipment Only
(per unit)

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
94.5	0.05	2			
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS _____ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED _____ (Specify Units of Measure)

OTHER FUEL _____ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED _____ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only [ ] 67-1 Process Heat Only [X] 67-2 Percent Process Heat [ ] 68-69 Oil Burner Type [ ] 70 (1=Pressure Gun 2=Air Atomizer 3=Steam Atomizer 4=Rotary Cup) Coal Burner Type [ ] 71 (1=Cyclone 2=Stoker 3=Pulverized 4=Hand Fired)

Days Per Week [<1] 72 Days Per Year [13] 73-75

SEASONAL VARIATION IN OPERATION (PERCENT):

None [X] 76 Winter [ ] 77-78 Spring [ ] 79-80 Summer [ ] 81-82 Fall [ ] 83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
78	35	922	193
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day (Per Unit)

Particulate Matter	Oxides of Sulfur	Oxides of Nitrogen
80.4	106.6	857.5
99-104	105-110	111-116

Carbon Monoxide	Volatile Organic Compounds	PM-10
1875.8	209.0	80.4
117-122	123-128	129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP	SOx	NOx	CO	VOC	PM10
4	4	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? 86.3

Air and Radiation Management Administration Use Only

16. Date Rec'd Local _____ Date Rec'd State _____

Return to Local Jurisdiction Date _____ By _____

Rev'd by Local Jurisdiction: Date _____ By _____ Rev'd by State: Date _____ By _____

Acknowledgement Sent by State: Date _____ By _____

17. Inventory Date (MM/YY)	SCC Code	18. Annual Operating Rate	Maximum Design Hourly Rate
171-174	178-185	186-192	193-199

Permit to Operate Month	Transaction Date	Staff Code	VOC	SIP Code
200-201	202-207	208-210	211 212	213 214

Regulation Code [ ] 215-218 Confidentiality [ ] 219

Point Description [ ] 220-238 Action [ ] 239 A: Add C: Change

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APPLICATION FOR FUEL BURNING EQUIPMENT

Permit to Construct ☒ Registration Update ☐ Initial Registration ☐

1A. Owner of Equipment/Company Name
UniStar Nuclear Operating Services, LLC

Mailing Address/Street
750 East Pratt Street

City: Baltimore | State: MD | Zip Code: 21202

Telephone Number (410) 470-5518

Print Name/Title
Tom Roberts, VP Calvert Cliffs Nuclear Power Plant New Generation Project

Signature: Date:

DO NOT WRITE IN THIS BOX

2. Registration Number

County No. (1-2) | Premises No. (3-6)
Registration Class (7) | Equipment No. (6-11)
Data Year (12-13) | Application Date

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):
1650 Calvert Cliffs Parkway, Lusby, MD 20657 (410) 495-4600

Premises Name (if different from above):

3. Status

A= New Equipment
B= Modification to Existing Equipment
C= Existing Equipment

Status	New Construction Began (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A	0411	0815	
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
Two identical emergency diesel generators, each with a 5,000 kWe rating. (SBO 1&2)

5. Workmen's Compensation Coverage: Binder/Policy Number: To be determined

Company Name: _____ Expiration Date _____

NOTE: Before a Permit to Construct may be issued by the Department, the applicant must provide the Department with proof of worker's compensation coverage as required under Section 1-202 of the Worker's Compensation Act.

6. Number of Pieces of Identical Equipment to be Registered/Permitted at this Time: 2

7. Person Installing this Equipment (if different from above give Name/Title, Company Name, Mailing Address and Telephone Number): N/A

8. Major Activity, Product or Service of Company at this Location:
Electric power generation

9. Control Devices Associated with this Equipment

None ☐ (24-0) | Simple/Multiple Cyclones ☐ (24-1) | Spray/Adsorb Tower ☐ (24-2) | Venturi Scrubber ☐ (24-3) | Carbon Adsorber ☐ (24-4) | Electrostatic Precipitator ☐ (24-5) | Bag-house ☐ (24-6)

Thermal/Catalytic Afterburner ☐ (24-7) | Dry Scrubber ☐ (24-8) | Other ☐ (24-9) | Describe _____

Form number: 11
Revision date: 09/27/2002
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10. Annual Fuel Consumption for this Equipment Only
(per unit)

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
33.2	0.0015	2			
26-31	32-33	34	35-41	42-45	

COAL- TONS	SULFUR %	ASH%	WOOD-TONS	MOISTURE %
46-52	53-55	56-58	59-63	64-65

OTHER FUELS _____ (Specify Type) [ ] 66-1 ANNUAL AMOUNT CONSUMED _____ (Specify Units of Measure)

OTHER FUEL _____ (Specify Type) [ ] 66-2 ANNUAL AMOUNT CONSUMED _____ (Specify Units of Measure)

1= Coke 2= COG 3=BFG 4=Other

11. Operating Schedule (for this equipment)

Comfort/Space Heating Only [ ] 67-1 Process Heat Only [X] 67-2 Percent Process Heat [ ] 68-69 Oil Burner Type [ ] 70 (1=Pressure Gun 2=Air Atomizer 3=Steam Atomizer 4=Rotary Cup) Coal Burner Type [ ] 71 (1=Cyclone 2=Stoker 3=Pulverized 4=Hand Fired)

Days Per Week [<1] 72 Days Per Year [6] 73-75

SEASONAL VARIATION IN OPERATION (PERCENT):

None [X] 76 Winter [ ] 77-78 Spring [ ] 79-80 Summer [ ] 81-82 Fall [ ] 83-84

12. Exhaust Stack Information

Height Above Ground (ft)	Inside Diameter at Top (inches)	Exit Temperature (°F)	Exit Velocity (ft/sec)
78	25	922	186
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day (Per Unit)

Particulate Matter	Oxides of Sulfur	Oxides of Nitrogen
132.2	1.7	2910
99-104	105-110	111-116

Carbon Monoxide	Volatile Organic Compounds	PM-10
1322.6	291.2	132.2
117-122	123-128	129-134

14. Method Used to Determine Emissions (1=Estimate, 2=AP42, 3=Stack Test, 4=Other Emission Factor)

TSP [4] 165 SOx [4] 166 NOx [4] 167 CO [4] 168 VOC [4] 169 PM10 [4] 170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? 45.5

Air and Radiation Management Administration Use Only

16. Date Rec'd Local _____ Date Rec'd State _____

Return to Local Jurisdiction Date _____ By _____

Rev'd by Local Jurisdiction: Date _____ By _____ Rev'd by State: Date _____ By _____

Acknowledgement Sent by State: Date _____ By _____

17. Inventory Date (MM/YY)	SCC Code	18. Annual Operating Rate	Maximum Design Hourly Rate
171-174	178-185	186-192	193-199

Permit to Operate Month	Transaction Date	Staff Code	VOC	SIP Code
200-201	202-207	208-210	211 212	213 214

Regulation Code [ ] 215-218 Confidentiality [ ] 219

Point Description [ ] 220-238 Action [ ] 239 A: Add C: Change

Appendix B

FLM Correspondence on Class I Modeling Waiver

Paine, Bob

From: John_Notar@nps.gov
Sent: Thursday, March 13, 2008 5:31 PM
To: Paine, Bob
Cc: BOB.SUSSMAN@LW.com; chuber@fs.fed.us; deborah.jennings@dlapiper.com; Lutchenkov, Dimitri; Decker, Lisa; Iwanchuk, Bob; Tim_Allen@fws.gov; John_D_Ray@nps.gov; John_Bunyak@nps.gov; Don_Shepherd@nps.gov; John_Vimont@nps.gov; John_Notar@nps.gov
Subject: Re: checking on review status: PSD modeling protocol for Calvert Cliffs Unit 3

Importance: High

Bob: Given the size and distance to SHEN (Q/D = 1.7), the NPS is screening this one out. We did not review the protocol; therefore we are not agreeing or disagreeing to anything in the protocol.
thanks
John

John Notar
National Park Service
Air Resources Division
12795 W. Alameda Pkwy.
Lakewood, CO 80228
Phone: 303-969-2079
Fax: 303-969-2822
E-Mail: john_notar@nps.gov

"Paine, Bob"
<BPaine@ensr.aecom.com>

03/11/2008 09:14 PM AST

To
<John_Notar@nps.gov>, <Tim_Allen@fws.gov>, <chuber@fs.fed.us>

cc
"Lutchenkov, Dimitri" <Dimitri.Lutchenkov@constellation.com>, "Iwanchuk, Bob" <riwanchuk@ensr.aecom.com>, "Decker, Lisa" <Lisa.Decker@constellation.com>, <BOB.SUSSMAN@LW.com>, <deborah.jennings@dlapiper.com>

Subject
checking on review status: PSD modeling protocol for Calvert Cliffs Unit 3

John, Tim, and Cindy,

Could you let me know if you have a date by which you can discuss the requested waiver for analysis of PSD Class I impacts from the proposed Calvert Cliffs Unit 3?

Bob

From: Paine, Bob
Sent: Wednesday, March 05, 2008 6:46 PM
To: 'John_Notar@nps.gov'; 'Tim_Allen@fws.gov'; 'chuber@fs.fed.us'
Cc: 'Lutchenkov, Dimitri'; Iwanchuk, Bob; Decker, Lisa; BOB.SUSSMAN@LW.com; deborah.jennings@dlapiper.com; 'bpaul@mde.state.md.us'; 'SGray@dnr.state.md.us'; 'RMcLean@dnr.state.md.us'
Subject: PSD modeling protocol for Calvert Cliffs Unit 3

Dear John, Tim, and Cindy,

On behalf of Unistar Nuclear Energy, LLC, a PSD permit applicant, I am providing you in a separate e-mail (due to its large size, slightly over 10 MB) with a modeling protocol document for a proposed project in southern Maryland. The proposed project involves an expansion at the existing Calvert Cliffs Nuclear Power Plant (installation of Unit 3). Air emissions associated with this proposed project's operation will be limited to PM10 releases from cooling towers (mostly salt particles) and very low SO2, NOx, and PM10 emissions due to the occasional testing and very limited backup power operation of emergency diesel generators and station blackout generators.

Total proposed annual emissions related to the project are as follows:

SO2: 1.34 TPY

NOx: 22.84 TPY

PM10: 249.36 TPY (mostly salt particles from the cooling tower).

Approximate distances to PSD Class I areas within 300 km (see figure in the protocol) are as follows:

- Shenandoah National Park: 160 km,
- Brigantine Wilderness Area: 220 km
- Dolly Sods Wilderness Area: 260 km
- Otter Creek Wilderness Area: 280 km
- James River Face Wilderness Area: 280 km.

Due to the low project emissions and large distances to the Class I areas, the applicant requests a case-specific waiver of PSD Class I area modeling

requirements from the Federal Land Managers.

We would like to expedite your review of this protocol, so if you agree to a case-specific waiver, then it would be appropriate for you to send an e-mail to that effect to the recipients of this message. It would also be appropriate to send a letter confirming this decision to the Maryland Department of the Environment (Bill Paul) and to the Maryland Power Plant Research Program (Susan Gray and Richard McLean).

We would like to have a conference call to discuss the waiver request, and any other Class I-related issues mentioned in the protocol, if applicable. Please indicate your availability for such a conference call on or after Thursday, March 13 in a return e-mail message to me.

Important: If you do not receive a separate e-mail with the modeling protocol attached from me soon after receiving this message, please inform Bob Iwanchuk at riwanchuk@ensr.aecom.com, and he will arrange for an alternative means to get the document to you. If others within your organization need to review the protocol document, please provide them with a copy.

Regards,

Bob Paine, CCM, QEP

Technical Director

Direct line 978.589.3164

ENSR Corporation

2 Technology Park Drive

Westford, MA 01886

fax: 978.589.3374

e-mail: bpaine@ensr.aecom.com

Paine, Bob

From: Cindy M Huber [chuber@fs.fed.us]
Sent: Thursday, March 13, 2008 10:13 AM
To: Paine, Bob; Andrea Stacy
Cc: BOB.SUSSMAN@LW.com; bpaul@mde.state.md.us; deborah.jennings@dlapiper.com; Lutchenkov, Dimitri; John_Notar@nps.gov; Decker, Lisa; Iwanchuk, Bob; RMcLean@dnr.state.md.us; SGray@dnr.state.md.us; Tim_Allen@fws.gov
Subject: Re: PSD modeling protocol for Calvert Cliffs Unit 3

Dear Bob,

Thanks for informing me of this project and providing the modeling protocol. I have reviewed the information you provided and agree that a Class I impact analysis for Air Quality Related Values is not necessary for the Forest Service managed Class I areas; Dolly Sods Wilderness and Otter Creek Wilderness in West Virginia, and James River Face Wilderness in Virginia. Should emissions from your project increase, please notify me so that we can re-evaluate the situation.

This message will serve as the Forest Service communication to the Maryland Department of the Environment and Maryland Power Plant Research Program that Class I AQRV analyses for the Forest Service managed Class I areas are not necessary.

Regards,

Cindy

****
Cindy M. Huber
Air Resource Specialist
USDA Forest Service
5162 Valleypointe Parkway
Roanoke, VA 24019

Phone 540-265-5156
Fax 540-265-5145
Email chuber@fs.fed.us

www.fs.fed.us/air
****

"Paine, Bob"
<BPaine@ensr.aecom.com>

03/05/2008 06:46 PM

To
<John_Notar@nps.gov>,
<Tim_Allen@fws.gov>,
<chuber@fs.fed.us>

cc
"Lutchenkov, Dimitri"
<Dimitri.Lutchenkov@constellation.com>, "Iwanchuk, Bob"
<riwanchuk@ensr.aecom.com>, "Decker, Lisa"
<Lisa.Decker@constellation.com>,
<BOB.SUSSMAN@LW.com>,
<deborah.jennings@dlapiper.com>,
<bpaul@mde.state.md.us>,
<SGray@dnr.state.md.us>,
<RMcLean@dnr.state.md.us>

Subject

PSD modeling protocol for Calvert Cliffs Unit 3

Dear John, Tim, and Cindy,

On behalf of Unistar Nuclear Energy, LLC, a PSD permit applicant, I am providing you in a separate e-mail (due to its large size, slightly over 10 MB) with a modeling protocol document for a proposed project in southern Maryland. The proposed project involves an expansion at the existing Calvert Cliffs Nuclear Power Plant (installation of Unit 3). Air emissions associated with this proposed project's operation will be limited to PM10 releases from cooling towers (mostly salt particles) and very low SO2, NOx, and PM10 emissions due to the occasional testing and very limited backup power operation of emergency diesel generators and station blackout generators.

Total proposed annual emissions related to the project are as follows:

SO2: 1.34 TPY

NOx: 22.84 TPY

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Approximate distances to PSD Class I areas within 300 km (see figure in the protocol) are as follows:

- Shenandoah National Park: 160 km,
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- Dolly Sods Wilderness Area: 260 km
- Otter Creek Wilderness Area: 280 km
- James River Face Wilderness Area: 280 km.

Due to the low project emissions and large distances to the Class I areas, the applicant requests a case-specific waiver of PSD Class I area modeling requirements from the Federal Land Managers.

We would like to expedite your review of this protocol, so if you agree to a case-specific waiver, then it would be appropriate for you to send an e-mail to that effect to the recipients of this message. It would also be appropriate to send a letter confirming this decision to the Maryland

www.ensr.aecom.com

Department of the Environment (Bill Paul) and to the Maryland Power Plant Research Program (Susan Gray and Richard McLean).

We would like to have a conference call to discuss the waiver request, and any other Class I-related issues mentioned in the protocol, if applicable. Please indicate your availability for such a conference call on or after Thursday, March 13 in a return e-mail message to me.

Important: If you do not receive a separate e-mail with the modeling protocol attached from me soon after receiving this message, please inform Bob Iwanchuk at riwanchuk@ensr.aecom.com, and he will arrange for an alternative means to get the document to you. If others within your organization need to review the protocol document, please provide them with a copy.

Regards,

Bob Paine, CCM, QEP

Technical Director

Direct line 978.589.3164

ENSR Corporation

2 Technology Park Drive

Westford, MA 01886

fax: 978.589.3374

e-mail: bpaine@ensr.aecom.com

Paine, Bob

From: Meredith_Bond@fws.gov
Sent: Monday, March 17, 2008 1:07 PM
To: Paine, Bob
Cc: Tim_Allen@fws.gov
Subject: Re: FW: checking on review status: PSD modeling protocol for Calvert Cliffs Unit 3

Bob,

FWS will not be needing any Class I analysis for the Brigantine Wilderness Area for the Unistar Nuclear Energy, LLC,Calvert Cliffs Unit 3 project, due to the low projected emission rates for the distance from the Class I area. As John Notar indicated, we are not specifically providing comment regarding the modeling protocol you presented for this project.

-- Meredith

CDR Meredith Bond, P.E., USPHS
Deputy Chief
U.S. Fish and Wildlife Service
Branch of Air Quality
7333 W Jefferson Ave., Suite 375
Lakewood, CO 80235
303-914-3808
303-969-5444 fax
Meredith_Bond@fws.gov

"Paine, Bob" <BPaine@ensr.aecom.com>

03/13/2008 04:19 PM

To <Meredith_Bond@fws.gov>
cc
Subject FW: checking on review status: PSD modeling protocol for Calvert Cliffs Unit 3

Meredith,

I believe that you may be the person at FWS who can decide upon a waiver of Class I modeling requirements for the proposed project. I think that Tim Allen forwarded the protocol to you.

Bob

-----Original Message-----
From: John_Notar@nps.gov [mailto:John_Notar@nps.gov]
Sent: Thursday, March 13, 2008 5:31 PM
To: Paine, Bob
Cc: BOB.SUSSMAN@LW.com; chuber@fs.fed.us; deborah.jennings@dlapiper.com; Lutchenkov, Dimitri; Decker, Lisa; Iwanchuk, Bob; Tim_Allen@fws.gov; John_D_Ray@nps.gov; John_Bunyak@nps.gov; Don_Shepherd@nps.gov; John_Vimont@nps.gov; John_Notar@nps.gov

Subject: Re: checking on review status: PSD modeling protocol for Calvert Cliffs Unit 3
Importance: High

Bob: Given the size and distance to SHEN (Q/D = 1.7), the NPS is screening
this one out. We did not review the protocol; therefore we are not agreeing
or disagreeing to anything in the protocol.
thanks
John

John Notar
National Park Service
Air Resources Division
12795 W. Alameda Pkwy.
Lakewood, CO 80228
Phone: 303-969-2079
Fax: 303-969-2822
E-Mail: john_notar@nps.gov

"Paine, Bob"
<BPaine@ensr.aecom.com>
03/11/2008 09:14 PM AST

To <John_Notar@nps.gov>, <Tim_Allen@fws.gov>, <chuber@fs.fed.us>

cc "Lutchenkov, Dimitri" <Dimitri.Lutchenkov@constellation.com>, "Iwanchuk, Bob" <riwanchuk@ensr.aecom.com>, "Decker, Lisa" <Lisa.Decker@constellation.com>, <BOB.SUSSMAN@LW.com>, <deborah.jennings@dlapiper.com>

Subject checking on review status: PSD modeling protocol for Calvert Cliffs Unit 3

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Cc: 'Lutchenkov, Dimitri'; Iwanchuk, Bob; Decker, Lisa; BOB.SUSSMAN@LW.com; deborah.jennings@dlapiper.com; 'bpaul@mde.state.md.us'; 'SGray@dnr.state.md.us'; 'RMcLean@dnr.state.md.us'
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Bob Iwanchuk at riwanchuk@ensr.aecom.com, and he will arrange for an alternative means to get the document to you. If others within your organization need to review the protocol document, please provide them with
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Regards,

Bob Paine, CCM, QEP

Technical Director

Direct line 978.589.3164

ENSR Corporation

2 Technology Park Drive

Westford, MA 01886

fax: 978.589.3374

e-mail: bpaine@ensr.aecom.com

Appendix C

Background Sources for Multi-Source Cumulative Modeling

Table C-1 PM_{10} Background Sources

StateFIPs+Facility ID	Allowable PM10 PRI Emissions (lbs/day)	Point ID	UTM-X-18-m	UTM-Y-18-m	Base Elevation (m)	Short-term Allowable Emissions (g/sec)	Stack Height (m)	Temp (K)	Velocity (m/s)	Diameter (m)
24009-009-0021-	56.00	26	376800	4249400	30.0	2.94E-01	8.2	314.8	30.5	1.2
24009-009-0021-	11.19	38	376800	4249400	30.0	5.87E-02	13.1	422.0	14.3	2.4
24009-009-0021-	13.58	36	376800	4249400	30.0	7.13E-02	13.1	422.0	14.3	2.4
24017-017-0014-	42.00	8	327100	4247200	0.0	2.20E-01	14.6	727.6	24.4	6.8
24017-017-0014-	44.00	7	327100	4247200	0.0	2.31E-01	14.6	727.6	24.4	6.8
24017-017-0014-	117.00	12	327100	4247200	0.0	6.14E-01	14.6	727.6	24.4	6.8
24017-017-0014-	118.00	10	327100	4247200	0.0	6.19E-01	14.6	727.6	24.4	6.8
24017-017-0014-	131.00	9	327100	4247200	0.0	6.88E-01	14.6	727.6	24.4	6.8
24017-017-0014-	139.00	11	327100	4247200	0.0	7.30E-01	14.6	727.6	24.4	6.8
24017-017-0014-	7.00	6	327100	4247200	0.0	3.67E-02	56.7	408.2	20.4	1.5
24017-017-0014-	8.00	5	327100	4247200	0.0	4.20E-02	56.7	408.2	20.4	1.5
24017-017-0014-	6766.00	15	327100	4247200	0.0	3.55E+01	213.4	405.4	30.5	5.9
24017-017-0014-	9155.00	14	327100	4247200	0.0	4.81E+01	213.4	405.4	30.5	5.9
24019-019-0029-	0.70	22	418400	4267700	6.0	3.67E-03	7.0	505.4	12.2	0.5
24019-019-0029-	3.30	21	418400	4267700	6.0	1.73E-02	7.0	505.4	12.2	0.5
24019-019-0029-	5.10	19	418400	4267700	6.0	2.68E-02	7.3	519.3	3.0	1.4
24019-019-0029-	16.20	35	418400	4267700	6.0	8.50E-02	9.1	422.0	9.1	0.6
24019-019-0029-	80.90	34	418400	4267700	6.0	4.25E-01	9.1	422.0	9.1	0.6
24033-033-0014-	59.26	6	353100	4267300	0.0	3.11E-01	9.1	755.4	27.4	3.1
24033-033-0014-	50.00	9	353100	4267300	0.0	2.62E-01	12.2	755.4	17.4	4.6
24033-033-0014-	25.69	14	353100	4267300	0.0	1.35E-01	64.9	813.2	32.3	5.6
24033-033-0014-	25.69	15	353100	4267300	0.0	1.35E-01	64.9	813.2	32.3	5.6
24033-033-0014-	38.81	16	353100	4267300	0.0	2.04E-01	64.9	814.8	34.4	5.6
24033-033-0014-	41.51	17	353100	4267300	0.0	2.18E-01	64.9	814.8	34.4	5.6
24033-033-0014-	1.52	13	353100	4267300	0.0	7.95E-03	67.1	588.7	9.4	2.1
24033-033-0014-	1232.93	8	353100	4267300	0.0	6.47E+00	213.4	644.3	9.1	5.1
24033-033-0014-	401.72	1	353100	4267300	0.0	2.11E+00	216.1	415.9	17.1	9.6
24033-033-0014-	417.93	2	353100	4267300	0.0	2.19E+00	216.1	415.9	17.1	9.6
24033-033-0014-	2330.58	7	353100	4267300	0.0	1.22E+01	217.0	395.9	19.2	7.6
24037-037-0017-	1.00	48	373200	4237600	17.7	5.25E-03	1.2	294.3	15.2	1.0
24037-037-0017-	4.00	153	373200	4237600	17.7	2.10E-02	3.7	294.3	19.5	0.3
24037-037-0017-	2.00	205	373200	4237600	17.7	1.05E-02	4.6	505.4	19.5	0.3
24037-037-0017-	1.00	194	373200	4237600	17.7	5.25E-03	6.1	477.6	15.2	0.3
24037-037-0017-	1.00	196	373200	4237600	17.7	5.25E-03	6.1	477.6	15.2	0.3
24037-037-0017-	7.00	195	373200	4237600	17.7	3.67E-02	6.1	477.6	15.2	0.3
24037-037-0017-	1.00	88	373200	4237600	17.7	5.25E-03	11.0	463.7	11.0	0.5
24037-037-0017-	1.00	89	373200	4237600	17.7	5.25E-03	11.0	463.7	11.0	0.5
24037-037-0017-	23.00	198	373200	4237600	17.7	1.21E-01	11.0	519.3	15.5	0.6
24037-037-0017-	3.00	199	373200	4237600	17.7	1.57E-02	21.3	533.2	4.3	1.5
24041-041-0069-	17.00	11	407100	4294200	9.0	8.92E-02	12.2	765.4	30.5	0.4
24041-041-0069-	17.00	12	407100	4294200	9.0	8.92E-02	12.2	765.4	30.5	0.4
24041-041-0069-	12.00	9	407100	4294200	9.0	6.30E-02	21.3	705.4	30.5	0.9
24041-041-0069-	73.00	8	407100	4294200	9.0	3.83E-01	21.3	634.3	24.4	1.0
24041-041-0069-	77.00	7	407100	4294200	9.0	4.04E-01	21.3	634.3	30.5	1.0
24041-041-0069-	210.00	10	407100	4294200	9.0	1.10E+00	21.3	705.4	30.5	0.9

Figure C-1 PM_{10} Background Sources

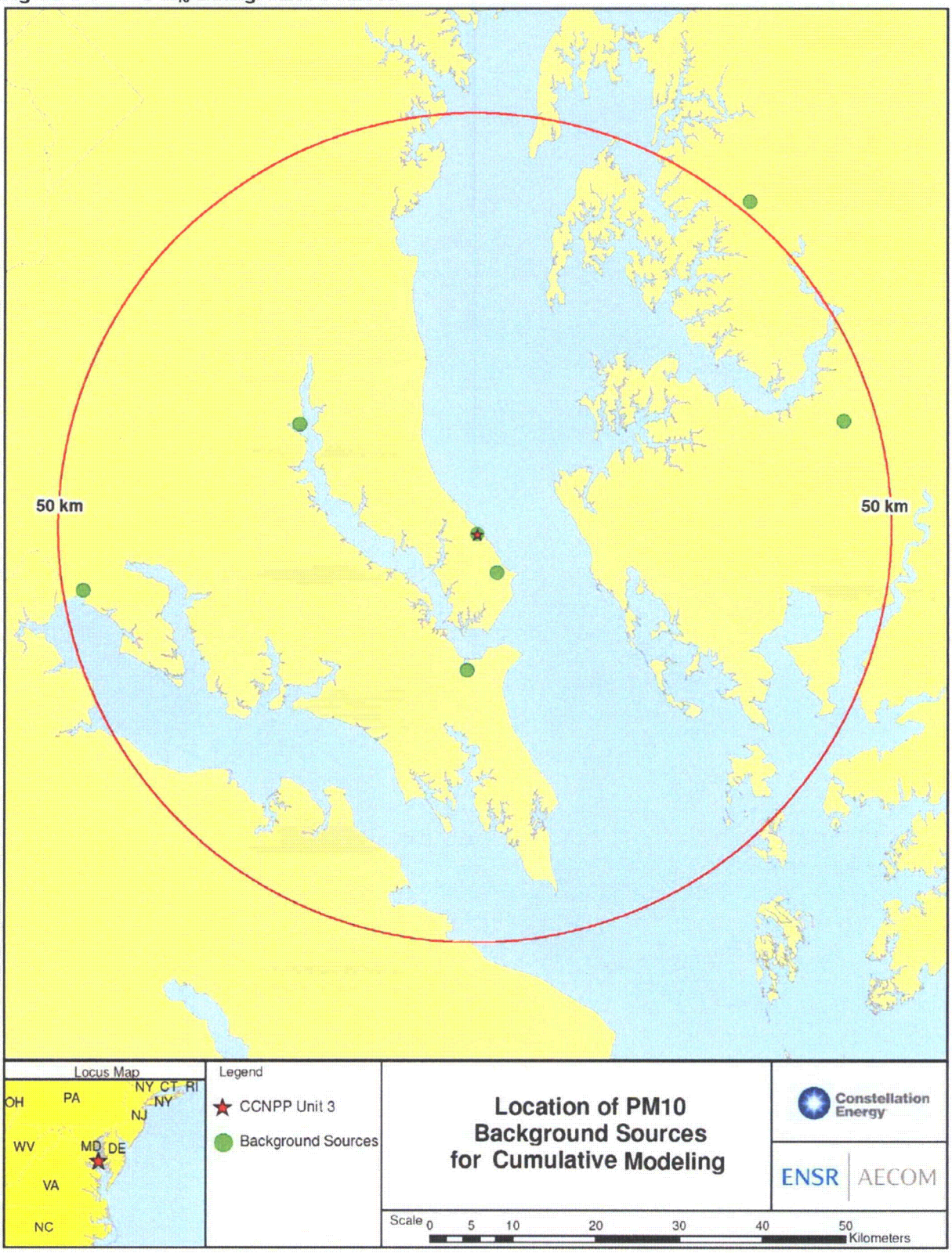

Table C-2 PM_{10} CCNPP Units 1-2 Emissions

Parameter	Units	Boiler 11	Boiler 12	EDG 2A	EDG 1B	EDG 2B	EDG 1A1	EDG 1A2	EDG OC1	EDG OC2	NS EDG
Heat Input	MMBtu/hr	164.00	164.00	36	36	36	13	13	13	13	20
Heating Value	Btu/gal	142,000	142,000	142,000	142,000	142,000	142,000	142,000	142,000	142,000	142,000
Power Generation	kWh	N.A.	N.A.	3,900	3,900	3,900	1,400	1,400	1,400	1,400	2,200
Sulfur Content	% wt.	0.05 (a)	0.05 (a)	0.05 (a)	0.05 (a)	0.05 (a)	0.05 (a)	0.05 (a)	0.05 (a)	0.05 (a)	0.05 (a)
Hourly Firing Rate	gph	1,155	1,155	254	254	254	92	92	92	92	141
Hours of Operation	hr/yr	1,400 (b)		1,000 (b)			800 (c)				N.A.
Annual Firing Rate	gpy	1,616,901		253,521			76,000 (c)				14,200 (d)
Emission Factors											
PM_{10}	lb/Mgal	2.30	2.30	13.12	13.12	13.12	13.12	13.12	13.12	13.12	13.12
PM_{10}	lb/hr	2.66	2.66	3.33	3.33	3.33	0.89 (e)	0.89 (e)	0.89 (e)	0.89 (e)	1.85

(a) Proposed limit on fuel oil sulfur content in amended Title V Permit.

(b) Proposed limit on annual hours of operation in amended Title V Permit.

(c) Limit on annual fuel use and hours of operation in current Title V Permit (800 hr/yr limit equivalent to 76,000 gpy of diesel fuel oil at 137,500 Btu/gal).

(d) Limit on annual fuel oil use in current Title V Permit.

(e) These backup power generators are rated at a capacity of 5.4 MW, but licensed to operate at a maximum of 4.0 MW for power backup involving Units 1 and 2. The power requirement is actually lower than 4.0 MW during most of the period of backup power while equipment operation is curtailed or shut down. The modeled PM10 emissions for the backup power case are consistent with the 4.0 MW power requirement.

Table C-3 PM_{10} CCNPP Units 1-2 Emissions and Stack Parameters

Date of Installation		1970	1970	1970	1970	1993	1993	1993	1992	1994
Parameter	**Units**	**Aux Boilers**	**EDG 2A**	**EDG 1B**	**EDG 2B**	**EDG 1A 1&2**	**EDG 0C1**	**EDG 0C2**	**Nuclear Security EDG**	**Blast**
Hourly Emissions										
PM_{10}	g/sec	6.69E-01	4.19E-01	4.19E-01	4.19E-01	2.24E-01	1.12E-01	1.12E-01	2.33E-01	2.70E-02
Stack Parameters										
UTM-X (Zone 18)	m	374,136	374,096	374,102	374,142	374,004	374,017	374,017	374,298	374,321
UTM-Y (Zone 18)	m	4,254,842	4,254,795	4,254,790	4,254,750	4,254,853	4,254,834	4,254,834	4,254,714	4,254,576
Stack Height	m	33.8	9.1	9.1	9.1	15.5	15.5	15.5	5.8	1.22
Base Elevation	m	13.7	13.7	13.7	13.7	13.7	13.7	13.7	15.2	12.2
Temperature	K	585.8	685.8	685.8	685.8	723	723	723	714	298
Velocity	m/s	10.1	0.001 (a)	0.001 (a)	0.001 (a)	0.001 (a)	0.001 (a)	0.001 (a)	60.2	57.9
Diameter	m	2.13	0.51	0.51	0.51	0.69	0.69	0.69	0.25	0.51
(a) Velocity of a horizontal release stack.										