Maillog No. 120029
Date: 11/20/2009

DLA Piper US LLP
111 South Calvert Street, Suite 1950
Baltimore, Maryland 21202-6193
www.dlapiper.com

Deborah E. Jennings
deborah.jennings@dlapiper.com
T 410.580.4180
F 410.580.3665

November 20, 2009

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

Re: Application of Calvert Cliffs 3 Nuclear Project, LLC and UniStar Nuclear Operating Services, LLC for a Certificate of Public Convenience and Necessity Authorizing the Modification of the Calvert Cliffs Unit 3 Project at Calvert Cliffs in Calvert County, Maryland

Dear Ms. Romine:

Please find enclosed for filing the Application of Calvert Cliffs 3 Nuclear Project, LLC and UniStar Nuclear Operating Services, LLC for a Certificate of Public Convenience and Necessity (CPCN) Authorizing the Modification of the Calvert Cliffs Unit 3 Project at Calvert Cliffs in Calvert County, Maryland. The Application has been submitted electronically, and included for filing is an original and seventeen copies of the Application.

Please do not hesitate to contact me if you have any questions.

Very truly yours,

DLA Piper US LLP

Deborah E. Jennings /ABS

Deborah E. Jennings

DEJ/pkp
Enclosures
cc: Service List

Maillog No. 120029
Date: 11/20/2009

CERTIFICATE OF SERVICE

On this 20th day of November, 2009, copies of the foregoing Application of Calvert Cliffs 3 Nuclear Project, LLC and UniStar Nuclear Operating Services, LLC (Co-Applicants) for a Certificate of Public Convenience and Necessity to modify the proposed new nuclear power plant at Calvert Cliffs in Calvert County, Maryland were mailed via first-class mail, postage prepaid or hand-delivered to the below-listed agencies in accordance with COMAR 20.79.02.02(B).

Agency	Number of Copies	Contact Information
Public Service Commission	• 1 original • 17 copies • 1 electronic copy	Terry J. Romine, Executive Secretary Maryland Public Service Commission William Donald Schaefer Tower 6 St. Paul Street, 16th Floor Baltimore, MD 21202-6806
Calvert County Board of County Commissioners	• 1 copy	Wilson H. Parran, President Calvert County Board of County Commissioners 175 Main Street Prince Frederick, MD 20678
Calvert County Department of Planning and Zoning	• 1 copy	Gregory A. Bowen, Director Calvert County Department of Planning and Zoning County Services Plaza 150 Main Street Prince Frederick, MD 20678
Calvert County Public Library	• 1 copy	Trudy Mihalcik, Branch Manager Calvert County Public Library Southern Branch 20 Appeal Lane Lusby, MD 20657
Maryland Department of Agriculture	• 1 copy	Earl F. Hance, Secretary Maryland Department of Agriculture 50 Harry S. Truman Parkway Annapolis, MD 21401
Maryland Department of the Environment	• 4 copies	Shari T. Wilson, Secretary Maryland Department of the Environment 1800 Washington Blvd., 7th Floor Baltimore, MD 21230
Maryland Office of Planning	• 1 copy	Richard Eberhart Hall, Secretary Maryland Department of Planning 301 W. Preston Street, Suite 1101 Baltimore, MD 21201-2305
Maryland Department of Natural Resources	• 6 copies	John R. Griffin, Secretary Maryland Department of Natural Resources 580 Taylor Avenue, C4 Tawes State Office Building Annapolis, MD 21401
Maryland Department of Business and Economic Development	• 1 copy	Christian Johansson, Secretary Maryland Department of Business and Economic Development 401 E. Pratt Street Baltimore, MD 21202

Maryland Department of Transportation	• 1 copy	Beverley Swaim-Staley Maryland Department of Transportation 7201 Corporate Center Drive Hanover, MD 21076
Maryland Aviation Administration	• 1 copy	Timothy Campbell, Executive Director Maryland Aviation Administration P.O. Box 8766 Third Floor, Terminal Building BWI Airport, MD 21240-0766
Maryland State Highway Administration	• 1 copy	Neil J. Pedersen, Administrator Maryland State Highway Administration 707 North Calvert Street, C-400 Baltimore, MD 21202
U.S. Department of the Interior	• 1 copy	Ken Salazar, Secretary U.S. Department of the Interior 1849 C Street, NW Mail Stop 7229 Washington, DC 20240
Federal Energy Regulatory Commission	• 1 copy	Kimberly D. Bose, Secretary Federal Energy Regulatory Commission 888 First Street, NE Washington, DC 20426
Federal Aviation Administration	• 1 copy	J. Randolph Babbitt Office of the Administrator Orville Wright Bldg. (FOB10A) FAA National Headquarters 800 Independence Avenue, SW Washington, DC 20591
Maryland Energy Administration	• 1 copy	Malcolm D. Woolf, Director Maryland Energy Administration 1623 Forest Drive Annapolis, MD 21403
Office of People's Counsel	• 1 copy	Paula M. Carmody, People's Counsel Maryland Office of People's Counsel William Donald Schaefer Tower 6 St. Paul Street, Suite 2102 Baltimore, MD 21202
U.S. Fish and Wildlife Service	• 1 copy	Sam D. Hamilton, Director U.S. Fish & Wildlife Service 1849 C Street, NW Mail Stop 3238 MIB Washington, DC 20240
Local electric company	• 1 copy	Austin J. Slater, Jr. President and Chief Executive Officer Southern Maryland Electric Cooperative 15035 Burnt Store Road PO Box 1937 Hughesville, MD 20637-1937

Deborah E. Jennings /ABS

Deborah E. Jennings, Esq.

Maillog No. 120029
Date: 11/20/2009

BEFORE THE
PUBLIC SERVICE COMMISSION
OF MARYLAND

IN THE MATTER OF:

APPLICATION OF CALVERT CLIFFS 3 NUCLEAR PROJECT, LLC AND UNISTAR NUCLEAR OPERATING SERVICES, LLC FOR A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY AUTHORIZING MINOR MODIFICATION OF THE CALVERT CLIFFS UNIT 3 PROJECT AT CALVERT CLIFFS IN CALVERT COUNTY, MARYLAND	)))))))	**Case No. ______**

<u>APPLICATION OF CALVERT CLIFFS 3 NUCLEAR PROJECT, LLC AND UNISTAR NUCLEAR OPERATING SERVICES, LLC FOR A CERTIFICATE OF PUBLIC CONVENIENCE AND NECESSITY AUTHORIZING MINOR MODIFICATION OF THE CALVERT CLIFFS UNIT 3 PROJECT AT CALVERT CLIFFS IN CALVERT COUNTY, MARYLAND</u>

Pursuant to Section 7-205 of the Maryland Public Utility Companies Article, and Title 20, Subtitle 79 of the Code of Maryland Regulations ("COMAR"), Calvert Cliffs 3 Nuclear Project, LLC ("CC3") and UniStar Nuclear Operating Services, LLC ("UNO") (collectively, "UniStar" or the "Applicants"), hereby request that the Commission issue a Certificate of Public Convenience and Necessity ("CPCN") authorizing: (1) the construction of certain minor additional sources of air emissions; (2) an alternative layout of certain already-approved sources of air emissions; and (3) minor changes in stack parameters for certain already-approved sources of air emissions, all to be part of the previously-approved new Unit 3 at the Calvert Cliffs Nuclear Power Plant in Calvert County, Maryland.

UniStar requests that this Application be reviewed by the Commission under § 7-205 as a modification to the Unit 3 Project authorized in Case No. 9127 and that it be docketed by the Commission as a new matter. § 7-205 defines a "modification" as a "physical alteration of . . . or other change to the facilities at a power plant . . . that could result in a change of the air emissions from the plant . . . ." The addition of air emitting sources constitutes a modification, within the meaning of § 7-205, to the facility approved in Case No. 9127 (the "Unit 3 Project"). The Applicants may elect to undertake construction of these new emitting sources in addition to the Unit 3 Project components that have already been approved. The potential alternative source locations and the changed source parameters are very minor in nature and UniStar does not anticipate that those changes will require amendments to the text of the final conditions contained in Case No. 9127.

The modification described in this Application will have limited impacts and will have either no effect or only a negligible effect on the overall Unit 3 Project impacts as described and approved in Case No. 9127 with respect to subject areas of Commission evaluation other than air emissions. Because the additional air emitting sources associated with the modification would potentially affect air emissions from the Unit 3 Project, UniStar has performed an evaluation to ensure that the incorporation of the features would have no unacceptable adverse impacts to air emissions and air quality as compared to the already-approved Unit 3 Project. UniStar is providing, with this Application, a complete Air Quality Analysis document (Attachment A) reviewing the air impacts of the operation of the entire Unit 3 Project, incorporating the new emitting sources and other changes described in this Application, and proposing emissions limitations for the additional air emitting sources. The Air Quality Analysis also updates the review of emission limitations for the Unit 3 Project and applicable air regulatory requirements. The Unit 3 Project, as modified, will continue to satisfy applicable air regulatory requirements; the approved emission limitations for the previously-approved Unit 3 Project sources remain valid.

I. The Applicants

CC3 and UNO are co-permittees for the already-issued CPCN and are the co-applicants for the CPCN sought by this Application. CC3, a Delaware limited liability company and a subsidiary of UniStar Nuclear Energy, LLC ("UNE"), will construct and own the proposed Calvert Cliffs Unit 3. UNE is a joint venture between subsidiaries of Constellation Energy Group, Inc. and Electricité de France, SA ("EDF"), the world's largest owner and operator of nuclear power stations. UNO is a wholly-owned subsidiary of UNE, formed for the purpose of being a licensee and operator of nuclear power plants. UNO will be the operator of Calvert Cliffs Unit 3.

II. The Existing Calvert Cliffs Facility and Unit 3 Project CPCN Authorization

The Calvert Cliffs Nuclear Power Plant ("CCNPP") facility is on a 2,070-acre campus in Calvert County, Maryland. There are two nuclear reactors (Units 1 and 2) currently in operation at CCNPP. In Case No. 9127, by Final Order on June 26, 2009, the Commission granted a CPCN authorizing the construction of a third reactor, designated Unit 3, to be constructed on a parcel on the southern portion of the CCNPP campus.[1] Unit 3 will generate approximately 1,600 MWs, nearly as much as the electric capacity of the entire existing facility. The features for which approval is sought in this Application relate only to portions of the Unit 3 Project on the south parcel of the CCNPP campus. Construction of Unit 3 has not yet begun and UniStar continues to obtain other approvals, including a Combined Operating License from the Nuclear Regulatory Commission and a Joint Federal/State Wetlands Permit from the Army Corps of Engineers and Maryland Department of the Environment.

[1] The Applicants note that requests for rehearing remain pending in Case No. 9127.

III. Description of the Modification Features

The modification sought in this Application consists of the addition of several minor sources of air emissions, the adoption of potential alternative source locations (within the same building) for certain of the previously-approved backup diesel generators, and changes to stack parameters for certain approved sources.

Four additional minor sources of air emissions are proposed: two emergency diesel-driven fire water pumps ("fire water pumps") and two sponge media blast units. The fire water pumps would be located within the Fire Protection Building. Each will have a maximum rated capacity of 440 brake-horsepower. The exhaust stacks for each fire water pump will be located on the roof of the Fire Protection Building and will have a height of approximately 7 meters. The sponge media blast units, which are used for equipment cleaning and surface preparation, are essentially a lower-emitting alternative to a sand-blast facility. Both the emergency diesel fire water pumps and the sponge media blast units are described in greater detail in the Air Quality Analysis and Appendices.

The Applicants propose alternative locations for the station blackout diesel generators ("SBOs"). The SBOs would still, as previously approved, be located inside a building adjacent to that containing the Unit 3 turbine. The SBOs and their stacks, however, would be configured differently within the building, as depicted and described in greater detail in the Air Quality Analysis. Additional minor changes to parameters of emitting units, involving small changes to stack heights, building heights, and/or precise source location, impact the cooling towers, the emergency diesel generators, and the SBOs, as described in detail in the Air Quality Analysis.

The incorporation of these features would have no different impact on the limits of disturbance of the project, wetland areas, areas subject to Critical Area requirements, and forested areas. With regard to the statutory areas of Commission consideration in granting a CPCN:

A. Stability and reliability of the electric system — The modification will not have any impact on stability or reliability issues.

B. Economics — The modification will have no impact on socioeconomics. No impact to employment will result. Any change in impacts to local or state taxes would be insignificant.

C. Aesthetics — The modification would have an insignificant impact on visual aesthetics.

D. Historic sites — The modification would not have any impact on historic sites, because it does not involve any different land use impacts from the already-approved Unit 3 Project and will not have any additional visual impacts.

E. Aviation safety — The modification would not have any impact on aviation safety. The relevant stack heights described in this Application have been submitted to the Federal Aviation Administration and have received a "determination of no hazard."

F. Air and water pollution — As noted above, an extensive air quality review of the Unit 3 Project incorporating the modification is being provided in the attached Air Quality Analysis. To summarize, there would be very slight increases in the potential to emit nitrogen oxides (NOx) and particulate matter; the effect on the air quality impacts of the Unit 3 Project would be minimal. No impact on water pollution is expected.

G. Availability of means for the required timely disposal of wastes — The modification would have a minimal impact on waste disposal. The sponge media blast units use a reusable sponge media abrasive that is recycled for reuse on site. Any wastes produced by the sponge media blast units or the emergency diesel fire water pumps will be disposed of in accordance with applicable requirements.

IV. Application Requirements

In accordance with the provisions of COMAR 20.79.01.04 (Application Filing Requirements), UniStar hereby states as follows:

A. The names of the Applicants are Calvert Cliffs 3 Nuclear Project, LLC and UniStar Nuclear Operating Services, LLC;

B. The address of the principal business office of the Applicants is 750 East Pratt Street, 14th Floor, Baltimore, Maryland 21202.

C. The following persons are authorized to receive notices and communications with respect to the Application:

Deborah E. Jennings
DLA Piper LLP US
111 South Calvert St., Suite 1950
Baltimore, Maryland 21202

Charles O. Monk, II
Saul Ewing LLP
500 East Pratt Street, 8th Floor
Baltimore, Maryland 21202

Edward P. Jarmas
General Manager, Calvert Cliffs 3 Nuclear Project, LLC
750 East Pratt Street, 14th Floor
Baltimore, Maryland 21202

D. Copies of the Application are being made available for public inspection and copying at the Calvert County Public Library, Southern Branch, 20 Appeal Lane, Lusby, Maryland 20657.

E. A list of each local, state, and federal government agency having authority to approve or disapprove the construction or operation of the Unit 3 Project was provided in the Technical Report in Case No. 9127 and is incorporated by reference. While the features that are the subject of this Application are within the scope of the Nuclear Regulatory Commission review of the Unit 3 Project and may be considered implicitly within the scope of other regulatory approvals, it is not anticipated that any other local, state, or federal agencies will have approval authority over the construction or operation of this modification, as distinct from the Unit 3 Project.

F. No transmission lines will be impacted by the modification.

G. A general description of the generating station modification under COMAR 20.79.03.01 is provided in Section III of this Application. Additional details of the description are found in the Air Quality Analysis.

H. The implementation schedule for the Unit 3 Project is currently projected to be as follows:

March, 2010 – CPCN application approval

4th Quarter, 2010 – Commencement of site preparation

Mid-2012 – Commencement of safety related construction

4th Quarter, 2017 – Commercial operation

I. The environmental information required under COMAR 20.79.03.02(B) is as follows:

(1) *General Information*: (a) The general description of the physical, biological, aesthetic, and cultural features, and conditions of the site and adjacent areas contained in UniStar's Application in Case No. 9127, as amended, is incorporated herein by reference. (b) The environmental and socioeconomic effects associated with modification are, as described above, limited to impacts on air emissions characteristics of the facility and are described in the attached Air Quality Analysis. (c) The Air Quality Analysis is the only study of environmental impact prepared by the Applicants for the modification. (d) As described in the Air Quality Analysis, the Project, including incorporating the modification, will conform to all applicable environmental standards.

(2) *Effect on Air Quality*: The effect on air quality is discussed in detail in the attached Air Quality Analysis.

(3) *Effect on Water Quality and Appropriation*: The modification will not have any effect on water quality and appropriation different from the design approved in Case No. 9127.

(4) *Effect on State or private wetlands*: The incorporation of the modification will not have any effect different from the design approved in Case No. 9127.

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(5) *Availability of means for disposal of plant-generated wastes*: Any wastes produced by the sponge media blast units or the emergency diesel fire water pumps will be disposed of in accordance with applicable requirements.

A signed verification as required under COMAR 20.79.02.01 follows.

V. Conclusion

UniStar has provided the information above and in the attached Air Quality Analysis in support of its request and respectfully requests that the Commission grant a CPCN authorizing construction of the above-described features no later than March 2010.

Charles O Monk /ABS

Charles O. Monk, II
J. Joseph Curran, III
Saul Ewing LLP
500 East Pratt Street, 8th Floor
Baltimore, Maryland 21202-3171
Telephone: 410.332.8668
Fax: 410.332.8870

Deborah E. Jennings /ABS

Deborah E. Jennings
F. William DuBois
DLA Piper LLP US
111 South Calvert Street, Suite 1950
Baltimore, Maryland 21202-6193
Telephone: 410.580.3000
Fax: 410.580.3665

VERIFICATION BY CO-APPLICANTS

I hereby swear that I am duly authorized to execute this application on behalf of Calvert Cliffs 3 Nuclear Project, LLC and that the contents of the application and the accompanying Technical Report are true and correct to the best of my knowledge, information, and belief.

E P Jarmas (Signature)
Edward P. Jarmas
General Manager
Calvert Cliffs 3 Nuclear Project, LLC

11/20/09 (Date)

I hereby swear that I am duly authorized to execute this application on behalf of Unistar Nuclear Operating Services, LLC and that the contents of the application and the accompanying Technical Report are true and correct to the best of my knowledge, information, and belief.

(Signature)
George Vanderheyden
President
Unistar Nuclear Operating Services, LLC

11/20/09 (Date)

ATTACHMENT A

Prepared for:
Calvert Cliffs 3 Nuclear Project, LLC and
UniStar Nuclear Operating Services, LLC
Lusby, MD

Air Quality Analysis for Modifications to Calvert Cliffs Nuclear Power Plant Unit 3

AECOM, Inc.
November 2009
Document No.: 01878-158-0002

AECOM

Prepared for:
Calvert Cliffs 3 Nuclear Project, LLC and
UniStar Nuclear Operating Services, LLC
Lusby, MD

Air Quality Analysis for Modifications to Calvert Cliffs Nuclear Power Plant Unit 3

Robert J. Paine

Prepared By: Robert J. Paine

Robert M Iwanchuk

Reviewed By: Robert M. Iwanchuk

AECOM, Inc.
November 2009
Document No.: 01878-158-0002

AECOM

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1.0 Introduction

1.1 Background

Calvert Cliffs 3 Nuclear Project LLC ("CC3") 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 addition of Unit 3 represents a major modification as defined under the federal Prevention of Significant Deterioration (PSD) regulations. The project is subject to PSD review for emissions of $PM/PM_{10}/PM_{2.5}$ only. As part of Public Service Commission (PSC or Commission) Case No. 9127, a PSD modeling report describing the air quality impacts of the proposed project was submitted to the PSC, the Power Plant Research Program (PPRP) and the Maryland Department of the Environment (MDE) in March 2008 (ENSR, 2008a), followed by an addendum describing slight proposed changes in August 2008 (ENSR, 2008b).

The MDE and the PPRP conducted their review of the dispersion modeling submittal, did some additional sensitivity modeling, and concluded that the proposed project would not contribute to or cause a violation of any applicable air quality standards. Effective June 26, 2009, the PSC issued the Certificate of Public Convenience and Necessity (CPCN) required prior to construction of CCNPP Unit 3. The CPCN also constitutes the issuance of the Air Quality Permit to Construct, including approval of a PSD permit.

Further review of the operating scenarios and vendor equipment specifications by UniStar has resulted in some proposed minor modifications and changes to previously-approved sources that warrant a modification to the PSD air quality analysis.

- Additional sources with relatively low emissions are being added, including two diesel fire water pumps and two sponge media blast units.
- Alternative source locations for the previously-approved station blackout generators (SBOs).
- Changes to certain stack parameters for previously-approved sources.

This document provides a description of the proposed modification to CCNPP Unit 3, an evaluation of alternative control technologies, a review of the dispersion modeling approach (described in a separate document[1] separately submitted to MDE), and the results of the air quality modeling analysis. No additional environmental or socioeconomic impacts are presented, as the modifications to the project do not change the conclusions of the previous analyses.

1.2 Organization of Document

Section 2 describes the planned modifications in emission sources for CCNPP Unit 3. The control technology evaluation for CCNPP Unit 3, including previously-approved sources and added sources is presented in Section 3. A description of dispersion modeling procedures are provided in Section 4, and the results of the modeling analysis are provided in Section 5.

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[1] "Briefing Document for Modeling Analysis for Modifications to Calvert Cliffs Nuclear Power Plant Unit 3", AECOM Document 01878-158-001, September 2009.

Information on the Sponge Media Blast Units is provided in Appendix A. Air permit application forms are provided in Appendix B. A more complete description of the quantification of particulate emissions is provided in Appendix C. Detailed information on the cooling tower drift elimination efficiency is provided in Appendix D. Background emission sources used in multi-source dispersion modeling are listed in Appendix E.

2.0 Planned Facility Modifications

2.1 Addition of New Emission Sources

UniStar proposes to add two emergency diesel fire water pumps and two sponge media blast units to the Unit 3 Project.

2.1.1 Emergency Diesel Fire Water Pumps

Two emergency diesel fire water pumps (FWPs) will provide backup fire protection in the event of loss of power at Unit 3. The two diesel FWPs will be located within the Fire Protection Building. Each of the diesel fire water pumps will have a maximum rated capacity of 440 brake-horsepower (bhp). The exhaust stack for each fire water pump will have a height of 7 meters and will be located on the roof of the Fire Protection Building.

The NO_x, CO and PM emissions from the two FWPs are based on compliance with the New Source Performance Standards for Compression Ignition Internal Combustion Engines under 40 CFR 60 Subpart IIII. According to 40 CFR §60.4205(c), NO_x, CO and PM from the FWPs are limited to 3.5 grams per brake-horsepower-hour (g/bhp-hr), 2.6 g/bhp-hr, and 0.15 g/bhp-hr, respectively. The diesel fuel cannot have a sulfur content that exceeds 15 parts per million by weight (ppmw) in accordance with 40 CFR §60.4207(b) and 40 CFR §80.510(b).

The diesel FWPs will occasionally be tested for periods of up to 4 consecutive hours per day, with testing limited to 500 hours per year. An initial modeling analysis was done to determine the worst-case consecutive 4-hour period to assign these emissions. The additional NO_x emissions of 1.46 tons per year bring the total facility emissions to 24.3 tons per year, which remains below the significance threshold of 25 tons per year. The estimated emissions and source parameters for these sources is provided in Table 2-1.

2.1.2 Sponge Media Blast Units

The proposed blast units use a composite of conventional abrasives and sponge-like polyurethane foam for surface preparation and cleaning of metal parts. The polyurethane sponge surrounds the point of abrasive impact, serving as a micro containment to capture airborne particulate emissions. Each of the sponge media blast units include: 1) a feed unit that delivers sponge media abrasives through a blast nozzle for surface preparation, 2) a vacuum ejector vented to a baghouse that draws sponge media through the vacuum head for recovery and/or recycling, 3) a recovery cyclone storage silo that separates recovered sponge media from the vacuum air stream, 4) a sponge-jet recycler which cleans and separates reusable sponge media abrasive, and 5) a feed unit cyclone storage silo that stores sponge media abrasive. Detailed specifications for the sponge media blast unit is provided in Appendix A.

Up to two media blast units will be in operation at any time. The units will be located in the paint shop building. Most of the emissions from blasting will be sponge media that will be captured within the paint shop and recycled (not emitted to the atmosphere). Particulate emissions from the vacuum ejector serving each blast unit will be controlled by a baghouse and will be discharged to the atmosphere through a common 21-ft stack located along one side of the paint shop. Daily emissions reflect an expected maximum operation of the units for up to 12 hours on any given day, and annual emissions reflect up to two 12-hour shifts each week. The estimated emissions and source parameters for the two media blast units are presented in Table 2-2.

Additional information on sponge media abrasives is available at Sponge-Jet Surface Preparation Technology: Clean | Dry | Low Dust | Reusable and http://www.spongejet.com/document_library/2_Product%20Information/Sponge-Jet%20B-VAC%20Pro.pdf).

Table 2-1: Model Input Data for the Diesel Fire Water Pumps

Parameter	Units	FWP 1	FWP 2	Total[d]
X (UTM Zone 18, NAD27)	m	374398.693	374396.059	N.A.
Y (UTM Zone 18, NAD27)	m	4254254.818	4254257.314	N.A.
Base Elevation	m	25.53	25.53	N.A.
Stack Height	m	7.0	7.0	N.A.
Exhaust Velocity	m/s	43.5	43.5	N.A.
Exhaust Temperature	°F	944	944	N.A.
Exhaust Diameter	m	0.2	0.2	N.A.
Engine Size	bhp	440	440	N.A.
Sulfur Content (a)	ppmw	15	15	N.A.
Hourly Firing Rate	gph	23	23	N.A.
Hours of Operation	hr/yr	500	500	N.A.
Emission Factors				
NO_x	g/bhp-hr	3.00 (b)	3.00 (b)	N.A.
SO_2	g/bhp-hr	0.0051 (c)	0.0051 (c)	N.A.
CO	g/bhp-hr	2.60 (b)	2.60 (b)	N.A.
PM	g/bhp-hr	0.15 (b)	0.15 (b)	N.A.
PM_{10}	g/bhp-hr	0.15	0.15	N.A.
$PM_{2.5}$	g/bhp-hr	0.14	0.14	N.A.
VOC	g/bhp-hr	0.30 (b)	0.30 (b)	N.A.
Hourly Emissions				
NO_x	lb/hr	2.91	2.91	5.82
SO_2	lb/hr	0.005	0.005	0.01
CO	lb/hr	2.52	2.52	5.04
PM	lb/hr	0.15	0.15	0.29
PM_{10}	lb/hr	0.15	0.15	0.29
$PM_{2.5}$	lb/hr	0.14	0.14	0.28
Annual Emissions				
NO_x	tpy	0.73	0.73	1.46
SO_2	tpy	0.001	0.001	0.002
CO	tpy	0.63	0.63	1.26
PM	tpy	0.04	0.04	0.07
PM_{10}	tpy	0.04	0.04	0.07
$PM_{2.5}$	tpy	0.04	0.04	0.07

(a) Based on compliance with 40 CFR §60.4207(b) and 40 CFR §80.510(b).
(b) Based on compliance with 40 CFR 4205(c).
(c) Based on material balance and maximum fuel oil sulfur content.
(d) Totals may not reflect sum of individual emission rates due to rounding of values reported from spreadsheet

Table 2-2: Model Input Data for Each Sponge Media Blast Unit

Parameter	Units	Emission Input Data
X (UTM Zone 18, NAD27)	m	373156.220
Y (UTM Zone 18, NAD27)	m	4254350.130
Base Elevation	m	39.8
Stack Height (off the 12DC cyclone)	m	6.4
Exhaust Flow	acfm	12000
Exhaust Temp	°F	75
Exhaust Diameter	inches	23.5 x 17.75 rectangular (b)
Maximum operating rate	lb/hr	360 (c)
Maximum daily operating hours	hr/day	12
Maximum annual operating hours	hr/yr	1248
Emission Factors		
PM	gr/actual ft^3	0.002 (d) (e)
PM_{10}	gr/actual ft^3	0.002 (d) (e)
$PM_{2.5}$	gr/actual ft^3	0.002 ((d) (e)
Hourly Emissions		
PM	lb/hr	0.206
PM_{10}	lb/hr	0.206
$PM_{2.5}$	lb/hr	0.206
Daily Emissions		
PM	lb/hr	0.103
PM_{10}	lb/hr	0.103
$PM_{2.5}$	lb/hr	0.103
Annual Emissions		
PM	tpy	0.128
PM_{10}	tpy	0.128
$PM_{2.5}$	tpy	0.128

(a) The exhaust from the sponge media blast units will be discharged via a common stack.
(b) For modeling purpose, the equivalent diameter for a 23.05" circular stack was used.
(c) Maximum process input rate with no recycling.
(d) 100% of PM_{10} is conservatively assumed to be $PM_{2.5}$
(e) 0.002 gr/actual ft^3 based on BACT

2.1.3 New Source Modeling Approach

The new compliance modeling demonstration has added the two fire water pump engines and the media blast unit emissions to each of the normal operations scenarios and they were modeled with the other sources with the conservative assumption that they are operating every day of the year. Table 2-3 identifies the sources that were included in air modeling for each operating scenario.

Table 2-3: Summary of Revised Operating Scenarios

Operating Scenario	Modeled Sources – Revised September 2009
Normal Operations	
Case 1: no backup power testing	CWS + 2 ESWS + fire water pumps + media blast units
Case 2: test emergency diesel gen.	CWS + 2 ESWS+1 EDG at 100% Load for 24 hrs + fire water pumps + media blast units
Case 3: test station blackout gen.	CWS + 2 ESWS+1 SBO for 24 hrs + fire water pumps + media blast units
Case 4: planned shutdown	CWS + 4 ESWS for 24 hours + fire water pumps + media blast units
Backup Power Operations	
Case 1: power from EDGs	4 EDGs at 100% Load + 4 ESWS for 4 hours, followed by 2 ESWS + 2 EDGs at 100% Load for 20 hrs, plus fire water pumps
Case 2: EDGs fail; use SBOs	2 ESWS + 2 SBOs for 8 hrs, plus fire water pumps
EDG denotes emergency diesel generator; SBO, station black-out generator; CWS, circulating water system cooling tower; ESWS, essential services water system cooling tower.	

2.1.4 Application for Permit-to-Construct

Appendix B provides the air permit application forms required for the proposed installation of the two FWPs and two sponge media blast units as required by COMAR 26.11.02.

2.2 Changes to Previously Modeled Emission Sources

In addition to the new sources added to the modeling scenarios, there have been some minor changes made to the sources previously modeled. The changes are as follows:

- minor changes in the location of sources and building structures that could affect plume rise and dispersion;
- minor changes in stack parameters; and
- alternative location of the SBO stacks.

Figure 2-1 provides a layout of the Unit 3 sources previously modeled, and Figure 2-2 shows the revised layout, including the location of the new sources described in Section 2-1. Figure 2-2 also shows the primary and alternative location of the SBO stacks. The project sources were modeled with the primary and alternative locations of the SBO stacks in separate runs. The SBO stack location choice with the higher modeled impact was used to conduct cumulative modeling.

Table 2-4 lists the maximum hourly and annual emissions from the Unit 3 cooling towers; these values are unchanged from the previous modeling analysis. Similarly, Table 2-5 provides the maximum hourly and annual emissions from the Unit 3 EDG and SBO engines providing backup power; these values are also unchanged from the previous analysis. Stack parameters for the sources previously modeled, with the updates as noted above, are provided in Table 2-6.

All other aspects of the modeled emissions for the Unit 3 pollutant sources are unchanged from the modeling done in 2008. This includes, for example, the CWS exhaust temperature as a function of ambient conditions and the air toxics emissions from the cooling towers.

Figure 2-1: Layout of CCNPP Unit 3 Emission Sources – Previously Modeled

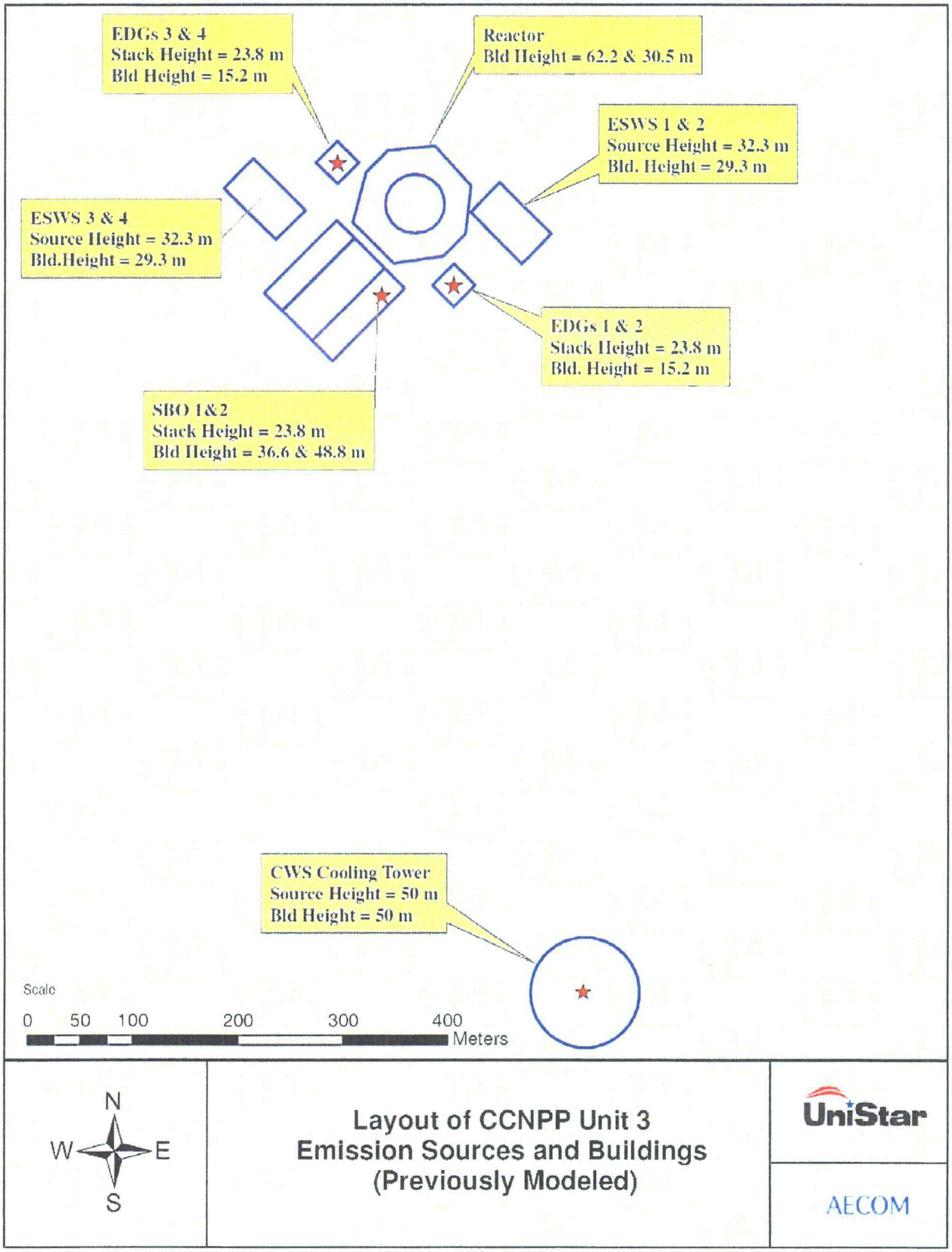

Figure 2-2: Layout of CCNPP Unit 3 Emission Sources – Revised

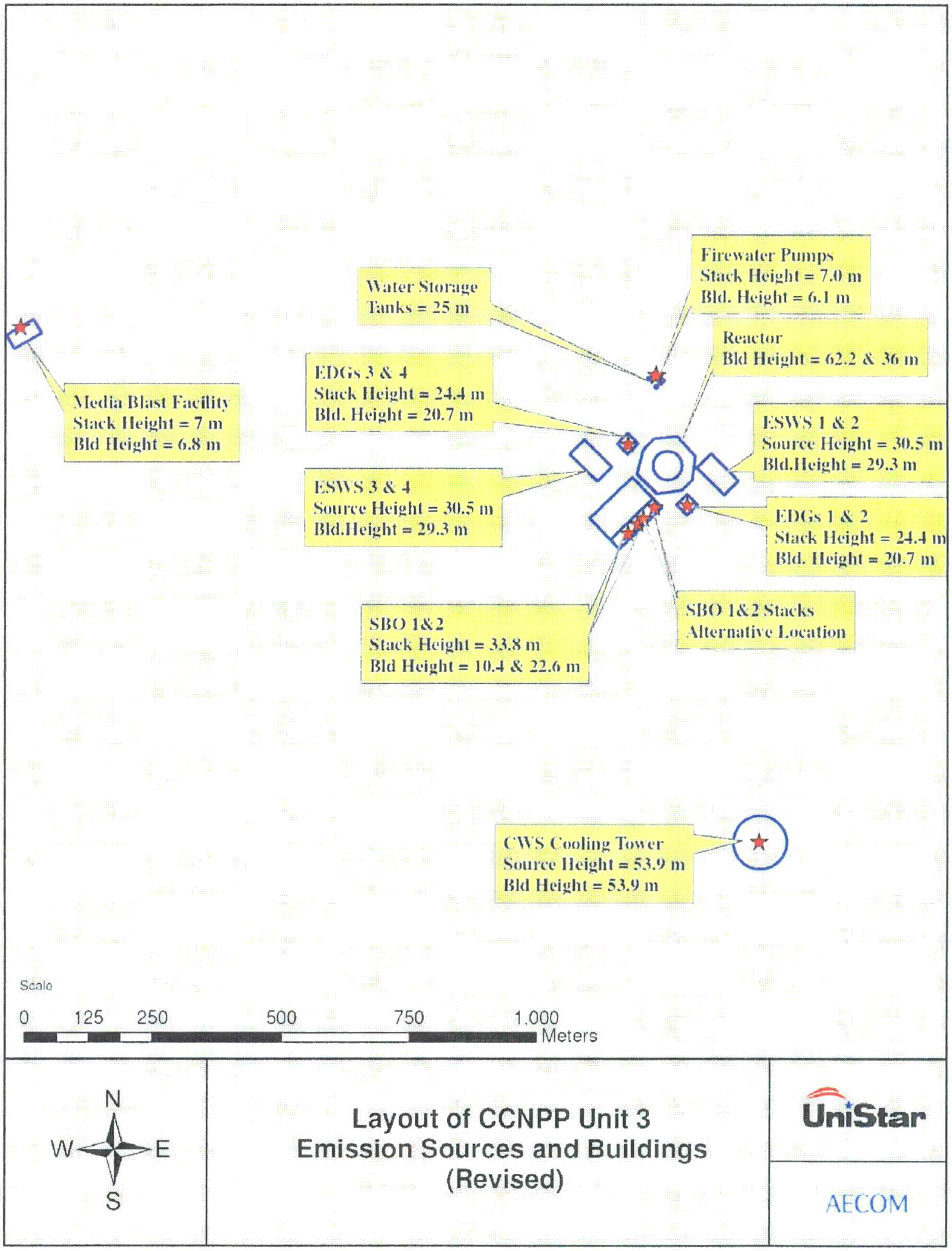

Table 2-4: Unit 3 Maximum Hourly and Annual Emissions from Cooling Towers[a]

Parameter	Units	CWS	ESWS (b)	Total(e)
No. of Units	N.A.	1	2	NA
Air Flow Rate	cfm	66,454,900 (c)	1,100,000	NA
Water Flow Rate	gpm	825,092 (c)	20,029	NA
Water Density	lb/gal	8.57 (d)	8.34	NA
Drift Rate	% CW	0.0005	0.005	NA
TDS (Make-up Water)	ppmw	17,500	372	NA
Cycles of Concentration	Ratio	2	10	NA
PM_{10}	Fraction	0.80	1.00	NA
$PM_{2.5}$	Fraction	0.13	0.32	NA
Hourly Emissions				
PM	lb/hr	74.25	3.73	77.97
PM_{10}	lb/hr	59.40	3.73	63.13
$PM_{2.5}$	lb/hr	9.65	1.19	10.85
Annual Emissions				
PM	tpy	325.20	16.33	341.53
PM_{10}	tpy	260.16	16.33	276.49
$PM_{2.5}$	tpy	42.28	5.23	47.50

(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 during any 24-hour period except for a planned shutdown case.

(c) The cooling tower air flow rates may be slightly higher than values reported above, and the water flow rates may be slightly lower. However, the stated values were used in the modeling for conservatism.

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

(e) Totals may not reflect sum of individual emission rates due to rounding of values reported from spreadsheet

Table 2-5: 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[(h)]
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.
SO_2	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.
PM_{10}	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
SO_2	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
PM_{10}	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
SO_2	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
PM_{10}	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 non-road 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.
(h) Totals may not reflect sum of individual emission rates due to rounding of values reported from spreadsheet

Table 2-6: Updated Unit 3 Stack Parameters

Parameter	Units	EDG 1&2	EDG 3&4	SBO 1	SBO 2	SBO 1 (alt location)	SBO 2 (alt location)	CWS	ESWS 1&2	ESWS 3&4
UTM-X (Zone 18, NAD27)	m	374458.482	374342.760	374362.175	374342.456	374393.852	374372.422	374599.090	374531.651	374283.443
UTM-Y (Zone 18, NAD27)	m	4254000.642	4254120.661	4253964.082	4253945.751	4253996.263	4253975.299	4253342.414	4254019.770	4254046.226
Stack Height	m	24.4	24.4	33.8	33.8	33.8	33.8	53.9	30.48	30.48
Base Elevation	m	25.45	25.45	25.45	25.45	25.45	25.45	25.45	25.45	25.45
Temperature	K	767.6	767.6	767.6	767.6	767.6	767.6	varies hourly	-	-
Velocity	m/s	58.7	58.7	56.8	56.8	56.8	56.8	3.62 (a)	-	-
Diameter	m	0.89	0.89	0.64	0.64	0.64	0.64	105	-	-
Area	m^2	-	-	-	-	-	-	-	3,040	3,040
(a) For Case 4, the CWS is conservatively assumed to operate at a 25% air flow rate.										

3.0 Control Technology Evaluation

3.1 Technical Approach

The Co-Applicants propose to design, construct, and operate Unit 3 at the Calvert Cliffs Nuclear Power Plant. According to 40 CFR 52.21(j)(2), the Co-Applicants must apply Best Available Control Technology (BACT) (expressed in terms of short-term emissions limits) for those pollutants that are emitted in significant quantities, that is, total particulate matter, particulate matter with a mean diameter of less than 10 microns (PM_{10}) and particulate matter with a mean diameter of less than 2.5 microns ($PM_{2.5}$). The proposed Unit 3 will include the following stationary sources of PM, PM_{10} and $PM_{2.5}$ emissions: CWS cooling tower, ESWS cooling tower, four emergency diesel generators (EDGs), two station blackout generators (SBOs), two diesel fire water pumps (FWPs), and two sponge media blast units.

This section documents the BACT analysis for PM_{10} and $PM_{2.5}$ emissions from the diesel FWPs and sponge media blasting units at CCNPP Unit 3. The original PSD report documented the BACT analysis for PM_{10} emissions from the CWS cooling tower, ESWS cooling towers, EDGs, and SBOs. This BACT analysis also demonstrates that the original BACT analysis for PM_{10} emissions is still current for these sources and that the original BACT analysis may be reasonably used as a surrogate for meeting the BACT requirements for $PM_{2.5}$ emissions from the sources at CCNPP Unit 3. This latter demonstration is intended to address the documentation issues mentioned in EPA's order addressing the PSD permit issued to the Louisville Gas and Electric Company for the construction of a new unit at the Trimble County Generating Station issued August 12, 2009 ("In the Matter of Louisville Gas and Electric Company, Trimble County, Kentucky Title V/PSD Air Quality Permit," Petition No. IV-2008-3). The Trimble County Order was published September 24, 2009 in the Federal Register (74 FR 48731).EPA's Trimble County Order provides EPA's suggested approach for demonstrating that PM_{10} is a reasonable surrogate for $PM_{2.5}$ with the following two steps.

- Establish a strong statistical relationship between PM_{10} and $PM_{2.5}$ emissions, in that the source's PM_{10} and $PM_{2.5}$ emissions are sufficiently related, to allow confidence that the proposed $PM_{2.5}$ emission rates will be met using the controls selected for PM_{10}. In contrast to the Trimble County Title V permit, which did not mention $PM_{2.5}$ emissions at all (providing no statistical correlation between PM_{10} and $PM_{2.5}$ emissions), the Co-Applicants meet this requirement by explicitly stating both the PM_{10} and $PM_{2.5}$ emissions from each permitted source, as well as the control efficiencies associated with each of the PM_{10} and $PM_{2.5}$ control devices..

- Demonstrate that the degree of control of $PM_{2.5}$ for the PM_{10} BACT analysis would be at least as effective as the control selected if a $PM_{2.5}$ BACT had been conducted. The Co-Applicants meet this requirement by presenting a $PM_{2.5}$ BACT analysis.

The development of the projected PM_{10} and $PM_{2.5}$ emissions from each source category is discussed in detail in Appendix C.

3.1.1 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 the 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 principal 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. Add-on controls typically are applied to combustion and process sources to further reduce emissions following changes in raw materials or process modifications. All three techniques have been applied to the FWPs and media blasting units to minimize PM, PM_{10} and $PM_{2.5}$ emissions.

In implementing the New Source Review (NSR) requirements for $PM_{2.5}$, the EPA has allowed the use of the PM_{10} program as a surrogate for meeting the $PM_{2.5}$ requirements during an interim prior to the adoption of specific $PM_{2.5}$ requirements. However, in the Trimble County order issued on August 12, 2009, the EPA indicated that a permit applicant should provide additional documentation to support its use of the PM_{10} surrogate policy, as noted above. Appendix C includes additional documentation to address this issue as it pertains to $PM_{2.5}$ emissions.

3.1.2 BACT Determination Precedents

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 coal-fired 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 emergency diesel FWPs and sponge media blast units at Unit 3.

3.2 BACT Analysis for New Emission Sources

This section provides the BACT analysis for PM_{10} and $PM_{2.5}$ emissions from the diesel FWPs and sponge media blast units that are the subject of this Application. The BACT analysis documents the particulate formation mechanisms for each emission source, the alternative control technologies available to reduce particulate emissions, and the preferred control strategy for satisfying BACT requirements.

3.2.1 Emergency Diesel Fire Water Pumps

The Co-Applicants propose to install two FWPs to provide backup fire protection in the event of loss of power at Unit 3. The FWPs are driven by diesel engines each with a maximum rated capacity of 440 bhp. Normal operation of the FWPs will be limited to periodic testing and maintenance activities to insure readiness and operability. It is assumed that each FWP will be occasionally tested for no more than 4 hours per day, with testing limited to no more than 500 hours per year.

3.2.1.1 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 vary with engine design; the control of the various components requires different control techniques given their chemical properties. The EPA approximates that 90% of the particles emitted from diesel engines have a mean diameter of less than 1 micron[2]. Likewise, the California Air Resources Board approximates that 98% of diesel particles are less than 10 microns in diameter, 94% are less than 2.5 microns in diameter, and 92% are less than 1.0 microns in diameter[3].

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. 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.

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[2] Health Effects Institute 1995. *Diesel Exhaust: A Critical Analysis of Emissions, Exposure, and Health Effects.* A Special Report of the Institute's Diesel Working Group, Cambridge, MA.
[3] California Air Resources Board 1998. *Findings of the Scientific Review Panel on the Report on Diesel Exhaust*, as adopted at the Panel's April 22, 1998 Meeting.

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 ultra-low sulfur diesel fuel, however, sulfate PM constitutes an extremely small portion of total PM.

3.2.1.2 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 emission standards established in the NSPS for Compression Ignition Internal Combustion Engines promulgated by the EPA in July 2006 (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 turbo-machinery 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. They 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 non-road 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.

A review of the EPA RACT/BACT/LAER Clearinghouse (RBLC) and state databases was conducted to determine the PM emission limits imposed on emergency diesel fire water pumps around the country. This review was limited to PSD permits issued for diesel fire water pumps issued in the last five years, 2005 through 2009. Table 3-1 summarizes the PM emission levels approved as BACT for diesel fire water pumps by the EPA and various state regulators. As shown in this table, the PM emissions levels for these diesel generators range from 1.0 to 0.15 g/bhp-hr. It should be noted that most of these diesel fire water pumps were installed after promulgation of the NSPS for Compression Ignition Internal Combustion Engines in July 2006.

Table 3-1: BACT Determinations for Emergency Diesel Fire Water Pumps

Facility	Date Issued	Rated Engine Capacity (bhp)	PM Emission Limit (g/bhp-hr)
Ohio River Clean Fuels, LLC	11/20/08	300	0.40
Competitive Power Ventures, Inc.	11/12/08	300	0.15
Southwest Electric Power Company	03/02/08	310	1.00
Caithness Blythe II, LLC	04/27/07	303	0.15
Crescent City Power, LLC	06/06/05	425	0.15

Source: EPA RACT/BACT/LAER Clearinghouse at http://cfpub.epa.gov/rblc/htm/bl02.cfm.

3.2.1.3 Proposed Particulate Controls

At this time, the Co-Applicants have not yet selected the diesel engine models for the diesel FWPs 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 FWPs will be designed to comply with the current PM emissions standard set forth in 40 CFR 60, Subpart IIII. For diesel engines with a maximum rated capacity of 440 bhp, the standards require that PM emissions must not exceed 0.15 g/bhp-hr [40 CFR 60.4205(d)]. Further, the diesel fuel sulfur content must not exceed 15 ppmw, limiting the sulfate portion of diesel PM emissions [40 CFR §60.4207(b) and 40 CFR §80.510(b)]. Because diesel particulate is almost entirely $PM_{2.5}$, diesel engine manufacturers must necessarily reduce $PM_{2.5}$ emissions to meet the PM emission standard set forth in the NSPS. Accordingly, compliance with these PM emission standards constitutes BACT for both PM_{10} and $PM_{2.5}$.

The NSPS defer to the regulations governing emissions from non-road compression ignition internal combustion engines promulgated by the EPA under 40 CFR Parts 89 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. The Co-Applicants are committed to acquiring diesel FWPs equipped with control technology that meets 40 CFR 60 Subpart IIII at the time of purchase. The use of the FWPs equipped with state-of-the-art controls, the use of ultra-low sulfur diesel fuel oil, and the limited use of the emergency diesel FWPs are considered representative of BACT for PM_{10} and $PM_{2.5}$.

3.2.2 Sponge Media Blasting Units

The Co-Applicants propose to install two sponge media blast units at CCPNN Unit 3. Most of the emissions from blasting will be sponge media that will be captured and recycled within the paint shop. Particulate emissions from the vacuum ejector will be discharged via a baghouse through a 21-ft stack located along one side of the paint shop. Daily emissions reflect a maximum operation of the two units for up to 12 hours on any given day, while annual emissions reflect up to two 12-hour shifts each week.

3.2.2.1 Particulate Formation

Each sponge media blasting units include: 1) a feed unit that delivers sponge media abrasives through a blast nozzle for surface preparation, 2) a vacuum ejector vented to a baghouse that draws sponge media through the vacuum head for recovery and/or recycling, 3) a recovery cyclone storage silo that separates recovered sponge media from the vacuum air stream, 4) a sponge media recycler which cleans and separates reusable sponge media abrasive, and 5) a feed unit cyclone storage silo that stores sponge media abrasive. The sponge media blasting units have inherently low PM emissions due to the enclosure of blasting operations and recovery of the sponge media. The only source of PM emissions is the vacuum ejector used to recover and recycle the sponge media, which is vented via a baghouse to the atmosphere.

3.2.2.2 Alternative Particulate Controls

The sponge media is a composite of conventional abrasives and sponge-like polyurethane foam. The sponge particle size is typically in the range of 3 to 6.5 millimeters and contains discrete abrasive particles that range from as large as 16 grit to as fine as 500 grit. Aluminum oxide is the most common abrasive used in sponge media; however, it may contain other abrasives such as plastic, glass bead, or steel grit. The most common combination of abrasive material and size in sponge media is a 30-grit aluminum oxide, known as Silver 30.

The polyurethane sponge surrounds the point of abrasive impact, thus forming a micro containment to capture airborne particulate emissions. The particles are separated from the sponge media through an on-site recycling procedure. Based on testing conducted by MRI[4], the sponge media can reduce PM emissions by approximately 97 to 98% compared to those associated with commonly used abrasives, such as coal slag and silica sand. This unit's emissions are much lower than the previous generation of sand blast units.

The sponge media is drawn by a vacuum ejector through the vacuum head for recovery and recycling. The vacuum ejector is discharged via a baghouse to the atmosphere. The baghouse will have a guaranteed grain loading of 0.002 grains per actual cubic foot (gr/acf). The particles released from the baghouse are almost entirely less than 2.5 microns in diameter.

3.2.2.3 Proposed Particulate Controls

The sponge media blasting units have inherently low PM emissions due to the enclosure of blasting operations and recovery of the sponge media. The only PM source is the vacuum ejector controlled by a baghouse with an outlet particulate grain loading of 0.002 gr/acf, the lowest grain loading currently guaranteed by baghouse vendors. Of the alternative PM control devices, baghouses provide the highest removal efficiency for particulate matter, especially for fine particulates (i.e., $PM_{2.5}$). The enclosure of blasting operations, the recovery of the sponge media, and the application of a high-efficiency baghouse are considered representative of BACT for PM_{10} and $PM_{2.5}$.

3.3 BACT Analysis for Previously Modeled Emissions Sources

This section demonstrates that the original BACT analysis for PM_{10} emissions is still current for these sources and that the original BACT analysis may be reasonably used as a surrogate for meeting the BACT requirements for $PM_{2.5}$ emissions from the cooling towers and emergency diesel generators at CCNPP Unit 3. This demonstration indicates that this updated BACT review and its conclusions are consistent with the BACT analysis that was relied upon for the CPCN issued effective June 26, 2009.

3.3.1 CWS and ESWS 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 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.

In wet cooling towers, drift is dependent on the flow rate of the circulating water, the TDS concentration in the circulating water, and the efficiency of the drift eliminators. 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.

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[4] Midwest Research Institute 2006, *Emission Characterization of Foam-Based Abrasive Blasting Media*, MRI Project No. 310613.1.001, January 13, 2006.

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 3-2 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 ranging from a high of 0.01 percent for the earliest installations to a low of 0.0005% for the most recent installations. At this time, cooling tower vendors will not guarantee drift eliminator efficiencies lower than 0.0005%. Note that the drift eliminator for the CWS cooling tower has been designed to achieve an efficiency of 0.0005%; the drift eliminator for the ESWS cooling towers, on the other hand, have been designed to achieve an efficiency of 0.005% (the highest efficiency level achievable by stainless steel drift eliminators).

Although PM removal efficiency tends to decrease slightly with finer particulate, drift eliminators are the only technically feasible means of reducing both PM_{10} and $PM_{2.5}$ emissions associated with cooling tower drift, and would therefore be selected as BACT. For example, if the drift eliminator loss is enhanced from 0.005% to 0.0005% of circulating water flow, the overall PM removal efficiency achieved would be 90%. In this case, the PM_{10} removal efficiency would be only slightly less than the overall PM removal efficiency (at 85%), and the $PM_{2.5}$ removal efficiency would be still relatively high as well (at 78%). The computation of relative PM removal efficiency as a function of particle size is provided in Appendix D.

The CWS and ESWS cooling towers will be equipped with high efficiency drift eliminators designed to remove both PM_{10} and $PM_{2.5}$. Drift eliminators are the only control devices available to reduce PM_{10} and $PM_{2.5}$ emissions resulting from the release of drift droplets from cooling towers. Therefore, the application of high efficiency drift eliminators to the CWS and ESWS cooling towers is considered representative of BACT for both PM_{10} and $PM_{2.5}$. This BACT result is consistent with the results of the earlier BACT analysis.

Table 3-2: 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 marc.strassman@etopiamedia.net.

3.3.2 Emergency Diesel Generators and Station Blackout 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.

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 vary with engine design and the control of the various components requires different control techniques given their chemical properties. The particle size distribution of diesel exhaust is bi-modal with a nuclei mode ranging from 0.0075 to 0.042 microns in diameter and an accumulation mode ranging from 0.042 to 1.0 microns in diameter[5]. Approximately 98% of the particles emitted from diesel engines are less than 10 microns in diameter, 94% less than 2.5 microns in diameter, and 92% less than 1.0 microns in diameter[6]. Accordingly, diesel particulate matter is comprised almost entirely of $PM_{2.5}$.

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 3-3 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 3-3: BACT Determinations for Large Emergency Diesel Generators

Facility	Date Issued	Rated Generating Capacity (kWe)	PM 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.

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 in order to comply with the ever more stringent PM emissions standards established in 40 CFR 60, Subpart IIII. 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

[5] Baumgard, K. J. and J. H. Johnson 1996. The Effect of Fuel and Engine Design on Diesel Exhaust Particle Size Distributions. SAE Technical Paper Series, #960131.

[6] California Air Resources Board 1998. *Findings of the Scientific Review Panel on the Report on Diesel Exhaust*, as adopted at the Panel's April 22, 1998 Meeting

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 then current PM emissions standards set forth in 40 CFR 60, Subpart IIII. The EDGs and SBOs will also fire low-sulfur and ultra-low sulfur diesel fuel oil, reducing sulfate particulate and thus total PM. Because diesel particulate is almost entirely $PM_{2.5}$, diesel engine manufacturers must necessarily reduce $PM_{2.5}$ emissions to meet the PM emission standard set forth in the NSPS. Accordingly, compliance with these PM emission standards constitutes BACT for both PM_{10} and $PM_{2.5}$. This BACT result is consistent with the results of the earlier BACT analysis.

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. The Co-Applicants are committed to acquiring EDGs and SBOs meeting the current 40 CFR 60 Subpart III requirements at the time of purchase. The use of emergency diesel engines equipped with state-of-the-art controls, the use of low-sulfur and ultra-low sulfur diesel fuel oil, and the limited use of the diesel generator are considered representative of BACT for PM_{10} and $PM_{2.5}$.

4.0 Dispersion Modeling Procedures

As in the case of the previous modeling analyses, the modeling of local impacts with the revised emission sources was conducted with AERMOD using the same on-site meteorological data and model receptors as before. The Federal Land Managers and MDE have previously waived the requirement to model PSD increment consumption and Air Quality Related Values at nearby PSD Class I areas. Due to the very minor change in total facility emissions associated with the additional sources, the waiver should also apply for this revised modeling.

There has been one change in the AERMOD modeling system since August 2008, and that change involves a new version of the terrain pre-processor, AERMAP. The AERMAP version 09040 was used in this compliance modeling analysis. The current version of the AERMET meteorological pre-process (version 06341) was used in 2008 for processing the meteorological data, so no new meteorological processing was needed. The current version of AERMOD, 07026, has not changed since 2008, so UniStar used that version for the revised modeling.

The same analysis procedures used before were applied to this compliance modeling demonstration:

- initial modeling was done to determine worst-case hours of operation for cases involving less than 24 hours of operation and the more restrictive location of the SBO stacks;

- modeling to determine the significant impact area was done first for each emission scenario; and

- pollutants for which there is a significant impact (PM_{10} and SO_2) were further analyzed with a background emission inventory and regional background concentration estimates that are the same as those used in 2008.

Compliance with the $PM_{2.5}$ NAAQS was demonstrated by compliance with the PM_{10} NAAQS under EPA's surrogate policy. It is noteworthy that the total emissions of PM_{10} are almost 6 times that of $PM_{2.5}$ for this project, a ratio that exceeds the PM_{10} to $PM_{2.5}$ NAAQS ratio, so that the PM_{10} modeling results would be expected to be more restrictive. This further supports the use of compliance with the PM_{10} NAAQS under the surrogate policy.

Other air quality impacts such as the toxics air pollutant analysis and salt deposition are presented in a manner consistent with the August 2008 modeling analysis.

5.0 Modeling Results for Unit 3 Modifications

The results of the initial modeling for the worst-case hours of the day for modeling the new sources resulted in the following determination of how to model these intermittent sources for the short-term modeling runs:

- the fire water pump testing is conservatively modeled for the hours of midnight through 4 AM each day
- the sponge media blast facility operation is conservative modeled for the hours of 8 PM through 8 AM each day.

AECOM also determined through modeling the more restrictive location of the SBO stacks, which was the "alternate" location, as shown in Figure 2-2. The modeling results thus support the placement of the SBO stacks at either location. Furthermore, worst-case hours for the emission units previously modeled were kept the same.

A significant impact analysis was conducted for PM_{10} (the PSD-applicable pollutant) as well as other criteria pollutants (SO_2, CO, and NO_x) with minor emissions associated with the operations of Unit 3. All of the peak impacts occurred close to the fenceline, within the 100-m spaced receptors used in the modeling. Therefore, no additional modeling with enhanced areas of receptors with 100-m spacing was required to determine the peak impacts. The AERMOD modeling results of Unit 3 emission sources are summarized in Table 5-1 for PM_{10}, Table 5-2 for SO_2, Table 5-3 for NO_x, and Table 5-4 for CO.

5.1 Modeling Results for Significant Impact Area Determination

Modeling of short-term criteria pollutant emissions was conducted for the four normal operations cases and two backup power operations cases. These cases are described in Section 2. Results are presented in Tables 5-1 through 5-4.

For PM_{10}, the revised modeling indicates that the normal operations case 1 still has insignificant impacts, while the remaining normal operations cases and the backup operations cases have a potential for a significant impact. The peak predicted impacts are generally all close to the Unit 3 location near the shore of Chesapeake Bay. The significant impact area (SIA), defined by the case with a significant impact farthest from the Unit 3 location, is about 1.7 km from Unit 3. 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 5.2.

The peak 24-hour modeled PM_{10} result for all cases is below the PSD pre-construction de minimis monitoring threshold of 10 µg/m^3. Therefore, the previous determination that no pre-construction monitoring is required is also found to be valid for this PSD permit modification.

The annual modeled PM_{10} impacts from the cooling tower, four EDGs and two SBOs resulted in concentrations of about 0.6 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.

The modeling results for SO_2 emissions are provided in Table 5-2. SO_2 emissions, which are present only for certain cases involving the operation of the backup diesel generator equipment, show significant impacts only for Backup Power Operations Case 1. The extent of the SIA for SO_2 is about 0.6 km.

Modeling results for NO_x and CO emissions are provided in Tables 5-3 and 5-4, respectively. The results indicate insignificant impacts for all cases modeled.

Table 5-1: PM_{10} Modeling Results of Unit 3 Emission Sources

Pollutant	Averaging Period	Operating Scenario	Modeled Sources	2001-2005 Max Modeled Concentration	Class II Significant Impact Level	De Minimis Conc.	NAAQS
				(μg/m³)	(μg/m³)	(μg/m³)	(μg/m³)
PM_{10}	24-hr	Normal Operations Case 1	CWS [(1)] & 2xESWS & 2xFWPs for 4 hrs & Media Blast Units	3.4	5	10	150
	24-hr	Normal Operations Case 2	CWS [(1)] & 2xESWS & 1xEDG at 100% Load for 24 hrs & 2xFWPs for 4 hrs & Media Blast Units	**5.6**	5	10	150
	24-hr	Normal Operations Case 3	CWS [(1)] & 2xESWS & 1xSBO for 24 hrs & 2xFWPs for 4 hrs & Media Blast Units	**6.8**	5	10	150
	24-hr	Normal Operations Case 4	CWS [(1,2)] & 4xESWS & 2xFWPs for 4 hrs & Media Blast Units	**7.3**	5	10	150
	24-hr	Backup Power Operations Case 1	4xESWS & 4xEDGs at 100% Load for 4 hrs; 2xESWS & 2xEDGs at 100% Load for 20 hrs & 2xFWPs for 4 hrs	**7.5**	5	10	150
	24-hr	Backup Power Operations Case 2	2xESWS & 2xSBOs for 8 hrs & 2xFWPs for 4 hrs	**6.5**	5	10	150
	Annual	Annual hours of operation	CWS [(1)] & 2xESWS & 4xEDGs & 2xSBOs & 2xFWPs & Media Blast Units	0.6	1	-	-

(1) CWS modeled with flow from the wet section and with the hourly excess exhaust temperature.

(2) CWS conservatively modeled with air flow rate at 25% and circulating water flow rate at 100% of capacity.

Table 5-2: SO_2 Modeling Results of Unit 3 Emission Sources

Pollutant	Averaging Period	Operating Scenario	Modeled Sources	2001-2005 Max Modeled Concentration (μg/m³)	Class II Significant Impact Level (μg/m³)	De Minimis Conc. (μg/m³)	NAAQS (μg/m³)
SO_2	3-hr	Normal Operations Case 2	1xEDG at 100% Load & 2xFWPs for 4 hrs	9.83	25	-	1,300
	3-hr	Normal Operations Case 3	1xSBO for 24 hrs & 2xFWPs for 4 hrs	0.21	25	-	1,300
	3-hr	Backup Power Operations Case 1	4xEDGs at 100% Load for 4 hrs; 2xEDGs at 100% Load for 20 hrs & 2xFWPs for 4 hrs	24.22	25	-	1,300
	3-hr	Backup Power Operations Case 2	2xSBOs for 8 hrs & 2xFWPs for 4 hrs	0.29	5	13	1,300
	24-hr	Normal Operations Case 2	1xEDG at 100% Load & 2xFWPs for 4 hrs	3.73	5	13	365
	24-hr	Normal Operations Case 3	1xSBO for 24 hrs & 2xFWPs for 4 hrs	0.18	5	13	365
	24-hr	Backup Power Operations Case 1	4xEDGs at 100% Load for 4 hr; 2xEDGs at 100% Load for 20 hrs & 2xFWPs for 4 hrs	**5.85**	5	13	365
	24-hr	Backup Power Operations Case 2	2xSBOs for 8 hrs & 2xFWPs for 4 hrs	0.06	5	13	365
	Annual	Annual hours of operation	4xEDGs & 2xSBOs & 2FWPs	0.02	1	-	80

Table 5-3: NO_x Modeling of Unit 3 Emission Sources

Pollutant	Averaging Period	Operating Scenario	Modeled Sources	2001-2005 Max Modeled Concentration	Class II Significant Impact Level	NAAQS
				(µg/m³)	(µg/m³)	(µg/m³)
NO_X	Annual	Annual hours of operation	4xEDGs & 2xSBOs & 2xFWPs	0.5	1	100

Table 5-4: CO Modeling of Unit 3 Emission Sources

Pollutant	Averaging Period	Operating Scenario	Modeled Sources	2001-2005 Max Modeled Concentration	Class II Significant Impact Level	De Minimis Conc.	NAAQS
				(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)
CO	1-hr	Normal Operations Case 2	1xEDG at 100% Load & 2xFWPs for 4 hrs	286.5	2,000	-	40,000
	1-hr	Normal Operations Case 3	1xSBO for 24 hrs & 2xFWPs for 4 hrs	208.7	2,000	-	40,000
	1-hr	Backup Power Operations Case 1	4xEDGs at 100% Load for 4 hrs; 2xEDGs at 100% Load for 20 hrs & 2xFWPs for 4 hrs	778.4	2,000	-	40,000
	1-hr	Backup Power Operations Case 2	2xSBOs for 8 hrs & 2xFWPs for 4 hrs	415.6	2,000	-	40,000
	8-hr	Normal Operations Case 2	1xEDG at 100% Load & 2xFWPs for 4 hrs	113.6	500	575	10,000
	8-hr	Normal Operations Case 3	1xSBO for 24 hrs & 2xFWPs for 4 hrs	72.6	500	575	10,000
	8-hr	Backup Power Operations Case 1	4xEDGs at 100% Load for 4 hrs; 2xEDGs at 100% Load for 20 hrs & 2xFWPs for 4 hrs	246.8	500	575	10,000
	8-hr	Backup Power Operations Case 2	2xSBOs for 8 hrs & 2xFWPs for 4 hrs	138.5	500	575	10,000

5.2 Cumulative Modeling Analysis Results

The significant impact analysis of the project sources showed that the short-term PM_{10} impacts are above the 24-hour SIL for several operational cases, and the short-term SO_2 impacts are above the 24-hour SIL for one backup power case. Therefore, cumulative modeling was conducted to show compliance with the short-term PM_{10} and SO_2 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 that account for distant or small local sources not explicitly modeled.

For the NAAQS compliance modeling analysis for PM_{10} and SO_2, AECOM modeled short-term 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. Due to updated information from Bechtel, minor changes in the locations of some of the existing point sources associated with CCNPP Units 1 and 2 were made. An emission inventory of the PM_{10} and SO_2 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). AECOM considered all background sources within the SIA plus 50 kilometers as candidates for the cumulative modeling. AECOM 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 for PM_{10}. For SO_2, a low Q/D value of 0.8 was used. These Q/D factors are consistent with procedures recommended by Mr. Donald Shepherd of the National Park Service for determining a PSD increment inventory. Although the factor of 0.3 or 0.8 are lower (and more conservative) than the values used for other NAAQS modeling, AECOM 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 E presents emissions and stack parameters of the sources that were included in the cumulative modeling. To the extent possible, stack location updates of the PM_{10} and SO_2 sources as well as the updated PM_{10} emissions for the Chalk Point and Morgantown power plants in Maryland identified by PPRP in their direct testimony in PSC Case No. 9127 have been incorporated into this modeling analysis.

The cumulative modeling results for PM_{10} NAAQS compliance are presented in Table 5-5. The total short-term impacts were estimated by adding the highest, second-high impact of all sources modeled to the background value of 38 $\mu g/m^3$ from the Mt. Vernon, VA monitor identified in the modeling protocol. 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.

The cumulative modeling results for SO_2 NAAQS compliance are presented in Table 5-6. Similar to PM_{10}, the total short-term impacts were estimated by adding the highest, second-high impact of all sources modeled to the background values of 55.9 and 26.2 $\mu g/m^3$ for the 3-hour and 24-hour averaging periods from the Cub Lee Run monitor identified in the modeling protocol. The short-term SO_2 total modeled impacts are well below than their respective NAAQS, so compliance with the short-term NAAQS is demonstrated.

Table 5-5: PM_{10} NAAQS Compliance Modeling Results

Pollutant	Averaging Period	Unit 3 Operating Scenario	Modeled Sources	H2H 2001-2005 Modeled Concentration	Ambient Monitoring Background	Total	NAAQS
				(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)
PM_{10}	24-hr	Normal Operations Case 2	Unit 1 & 2 &3 NAAQS & Major Sources	65.9	38	103.9	150
	24-hr	Normal Operations Case 3	Unit 1 & 2 &3 NAAQS & Major Sources	66.0	38	104.0	150
	24-hr	Normal Operations Case 4	Unit 1 & 2 &3 NAAQS & Major Sources	65.9	38	103.9	150
	24-hr	Backup Power Operations Case 1	Unit 1 & 2 &3 NAAQS & Major Sources	61.1	38	99.1	150
	24-hr	Backup Power Operations Case 2	Unit 1 & 2 &3 NAAQS & Major Sources	65.9	38	103.9	150

Table 5-6: SO_2 NAAQS Compliance Modeling Results

Pollutant	Averaging Period	Unit 3 Operating Scenario	Modeled Sources	H2H 2001-2005 Modeled Concentration	Ambient Monitoring Background	Total	NAAQS
				(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)
SO_2	3-hr	Backup Power Operations Case 1	Unit 1 & 2 & 3 NAAQS & Major Sources	116.6	55.9	172.5	1,300
	24-hr	Backup Power Operations Case 1	Unit 1 & 2 & 3 NAAQS & Major Sources	45.3	26.2	71.5	365

For the PSD increment modeling, AECOM used the same background inventory discussed above. 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 are overestimates.

The results of the PM_{10} short-term PSD increment modeling are presented in Table 5-7. 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.

Similarly, the results of the SO_2 short-term PSD increment modeling analysis, shown in Table 5-8, indicate that the PSD increment consumption from the proposed project will be well below applicable increment limits.

5.3 Toxic Air Pollutant Analysis

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. The screening values, estimated emission rates, and estimated ambient impacts for the CWS cooling tower are shown in Table 5-9. These predicted impacts are about 2-3% lower than those from the August 2008 revised analysis due to changes in stack characteristics. It is clear that the estimated ambient impacts are still well below the screening levels, so no additional analysis is needed for the TAP assessment.

Table 5-7: PSD Increment Compliance Modeling Results for PM_{10}

Pollutant	Averaging Period	Unit 3 Operating Scenario	Modeled Sources	H2H 2001-2005 Modeled Concentration ($\mu g/m^3$)	PSD Class II ($\mu g/m^3$)
PM_{10}	24-hr	Normal Operations Case 2	Unit 1 & 2 & 3 PSD & Major Sources	22.9	30
	24-hr	Normal Operations Case 3	Unit 1 & 2 & 3 PSD & Major Sources	23.2	30
	24-hr	Normal Operations Case 4	Unit 1 & 2 & 3 PSD & Major Sources	23.3	30
	24-hr	Backup Power Operations Case 1	Unit 1 & 2 & 3 PSD & Major Sources	23.2	30
	24-hr	Backup Power Operations Case 2	Unit 1 & 2 & 3 PSD & Major Sources	22.8	30

Table 5-8: PSD Increment Compliance Modeling Results for SO_2

Pollutant	Averaging Period	Unit 3 Operating Scenario	Modeled Sources	H2H 2001-2005 Modeled Concentration ($\mu g/m^3$)	PSD Class II ($\mu g/m^3$)
SO_2	3-hr	Backup Power Operations Case 1	Unit 1 & 2 & 3 PSD & Major Sources	80.1	512
	24-hr	Backup Power Operations Case 1	Unit 1 & 2 & 3 PSD & Major Sources	18.1	91

Table 5-9: 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	0.000691	0.000040 8-hour
Sodium Hydroxide	20 1-hour	0.000173	0.000039 1-hour
HEDP	82 8-hour (based on Oral Rat LD50 > 2,000 mg/kg)	0.000232	0.000013 8-hour
Petroleum Distillate	170 8-hour	0.0000734	0.0000042 8-hour

5.4 Other Air Quality Impacts

There are no changes due to the emission scenario adjustments to the discussion of project growth-related emissions provided in the March 2008 PSD Report. Similarly, the changes to PM_{10} emissions have a very small effect on the soils and vegetation impacts, including salt deposition. Changes in the predicted annual average results relative to the August 2008 revisions are very small (within about 1%), and the total salt deposition impacts would still be below 3% of the injury threshold for the most sensitive species. Therefore, the project modifications would not change the conclusion that the project will not have an adverse impact on soils and vegetation in the area.

5.5 PSD Class I Impacts

The short-term emissions of SO_2, NO_x, and PM_{10} are increased in this modification by only about 0.002, 1.46, and 0.20 tons per year, respectively. Therefore, the overall conclusion that the Class I impact analysis can be waived is not affected by this modification since the Q/D value was previously less than 2, and the threshold for a Federal Land Manager waiver of an impact analysis is stated as 10 in the 2008 FLAG guidance available at http://www.nature.nps.gov/air/permits/flag/index.cfm.

6.0 References

ENSR, 2008a. PSD Report for the Proposed Unit 3 at Calvert Cliffs Nuclear Power Plant. ENSR Document No. 04189-025-0016a. March, 2008.

ENSR, 2008b. Addendum to Modeling Analysis for the Proposed Unit 3 at Calvert Cliffs Nuclear Power Plant. ENSR Document No. 04189-025-0016b. August 2008.

Federal Land Managers 2008. Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I Report –Revised. Available at http://www.nature.nps.gov/air/Permits/flag/docs/FLAG_RevisedFinalDraft20080624.pdf.

UniStar 2007. 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. Dated as of November, 2007. Public Version.

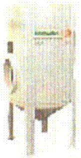
Appendix A

Information on Planned Sponge Media Blast Units

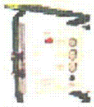
B-VAC™ Pro 3 - Integrated Sponge Blasting™ System - Tech Data

CONFIGURATION

400-HP Feed Unit™:

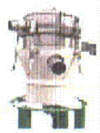


- 400L (14ft³) pressure vessel
- Customized agitation assembly with up to 1,360kg (3,000 lb) of force, 20,000 rotations per day
- Pneumatic, auger-based abrasive delivery system controls the quantity of abrasive mixed into the air stream
- 50mm (2in), high capacity piping and valve system
- Integrated, pneumatic Control Panel



- 15m (50ft) x 31.75mm (1.25in) Inside Diameter Blast Hose
- 12mm (.5in) wide entry, venturi nozzle
- Pneumatic deadman controls *(electric optional)*

50-P Sponge-Jet Recycler™:



- Oversized 50cm (19.5in) deck on vibratory media classifier, gasketed to maintain vacuum integrity
- Elevated Sponge-Jet Recycler allows gravity feed of waste to standard steel drums

High-Volume, Low Noise Vacuum Ejector:

- 630 Nm³/hr (370 cfm) Vacuum Ejector
- 76.5dB(a) low noise package
- 3800mm WC (11in of Hg) maximum suction
- 4.1nm³/min (145cfm) supply air at 7bar [100psi]) with 8kg (18lb/min) transport on 100m (300ft) hose
- Reverse air-cleaning, filter
- 15m (50ft) clear vacuum hose

High Strength Steel Frame:

- Robust design for use in shipyards and offshore applications
- Capable of lifting unit when full
- Extra fork pockets to accommodate variations
- Integrated ladder and platform assembly

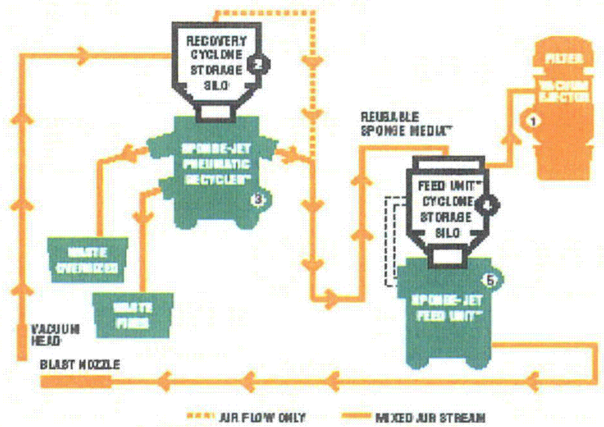
Cyclone Storage Silos with Inspection Ports:

- Cyclones separate Sponge Media abrasives from vacuum air stream
- Two over-sized buffer silos for the 50-P Recycler and the 400-HP Feed Unit

PROCESSING

(1) VACUUM EJECTOR: Draws Sponge Media abrasive from the vacuum head through all non-pressurized components.

(2) RECOVERY CYCLONE STORAGE SILO: Separates recovered Sponge Media abrasives from the vacuum air stream and stores it for automatic classification. Most of the vacuum airflow bypasses the Sponge-Jet Recycler and then rejoins the reusable Sponge Media abrasives to aid pneumatic transport to the Feed Unit Cyclone.



(3) SPONGE-JET RECYCLER: Under vacuum with minimal airflow, the Sponge-Jet Recycler cleans and separates reusable Sponge Media abrasive from waste material.

(4) FEED UNIT CYCLONE STORAGE SILO: Equipped with pneumatic actuator, this cyclone separates the reusable Sponge Media from the vacuum air stream, then stores it for automatic reloading into the Feed Unit. A specially configured deadman control begins cycling the actuator and then opens the pop-up valve, automatically reloading the Feed Unit when the deadman control is released.

(5) FEED UNIT: Regulates and delivers Sponge Media abrasives through the blast nozzle for surface preparation. Feed Units are designed to meet the specific flow characteristics of Sponge Media and allow for precise blast pressure and sponge media feed rate adjustment.

Visit Sponge-Jet, Inc. at **www.spongejet.com** or call **1-603-610-7950** (USA) for more about the Sponge Blasting™ System

Appendix B
Air 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
"CC3" and "UNO" (see below)

Mailing Address
750 East Pratt Street
Street Address

Baltimore MD 21202
City State Zip

Telephone Number
(410) 470-5857

Signature

Edward Jarmas, General Manager CC3
Print Name and Title Date

DO NOT WRITE IN THIS BLOCK
2. REGISTRATION NUMBER

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

Registration Class	Equipment No.
7	8-11

Data Year	Application Date
12-13	

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	New Construction Begun (MM/YY)	New Construction Completed (MM/YY)	Existing Initial Operation (MM/YY)
A	0 9 1 0	0 8 1 5	
15	16-19	20-23	20-23

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

5. Workmen's Compensation Coverage TBD TBD
Binder/Policy Number Expiration Date

Company

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 2

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

"CC3"=Calvert Cliffs Unit 3 Nuclear Project, LLC
"UNO"=Unistar Nuclear Operating Services, LLC

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

Name N/A 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
[ ]	[ ]	[ ]	[ ]	[ ]	X	[ ]	[ ]
24-1	24-2	24-3	24-4	24-5	24-6	24-7	24-8

Other [ ] Describe ______

24-9

10. Annual Fuel Consumption for this Equipment N/A (No Fuel Burned)

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	12	2	12	2	
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

If not, then	Height Avove Ground (FT)	Inside Diameter at Top	Exit Temperature (°F)	Exit Velocity (FT/SEC)
	21	1.92	Ambient+5F	69.0
	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. Sponge Material	N/A	360 (max)	lbs	225	tons
2.					
3.					
4.					
5.					
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.					
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. Paint and Metal Particles	N/A	unknown		unknown	
2. Sponge Materials	N/A	N/A		20.42	tons
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
2.472		
99-104	105-110	111-116

Carbon Monoxide	Volatile Organic Compounds	PM-10
		2.472
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
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	Equipment Code	SCC Code
171-174	175-177	178-185

20.

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

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

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

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 PERMIT TO CONSTRUCT
GAS CLEANING OR EMISSION CONTROL EQUIPMENT

1. Owner of Installation: "CC3" and "UNO" (see below)
Telephone No.: 410-470-5857
Date of Application: November 2009

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

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

4. Signature of Owner or Operator:
Title: General Manager CC3
Print or Type Name: Edward Jarmas

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

6. Date Construction is to Start: September 2010
Completion Date (Estimate): August 2015

7. Type of Gas Cleaning or Emission Control Equipment:

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

Scrubber [ ] ____________ (type) Other [X] Baghouse (type)

8. Gas Cleaning Equipment Manufacturer: Sponge Jet
Model No.:
Collection Efficiency (Design Criteria): 99.8%

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

Abrasive Blasting Reclaim

10. Stack Test to be Conducted:

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

11. Cost of Equipment ____________

Estimated Erection Cost ____________

"CC3"=Calvert Cliffs Unit 3 Nuclear Project, LLC
"UNO"=Unistar Nuclear Operating Services, LLC

12. The Following Shall Be Design Criteria:

	INLET		OUTLET	
Gas Flow Rate		ACFM*	12,000	ACFM*
Gas Temperature		°F	Ambient + 5	°F
Gas Pressure		INCHES W.G.		INCHES W.G.

PRESSURE DROP ____________

Dust Loading		GRAINS/ACFD**	0.002	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.

13. Particle Size Analysis

Size of Dust Particles Entering Cleaning Unit	% of Total Dust	% to be Collected
0 to 10 Microns		99.8
10 to 44 Microns		99.9
Larger than 44 Microns		100

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.

Please see attached drawing.

Date Received: Local ______________________________ State ______________________________

Acknowledgement Date: ____________________

By ____

Reviewed By:

Local ____

State ____

Returned to Local:

Date ________________

By ____

Application Returned to Applicant:

Date ________________

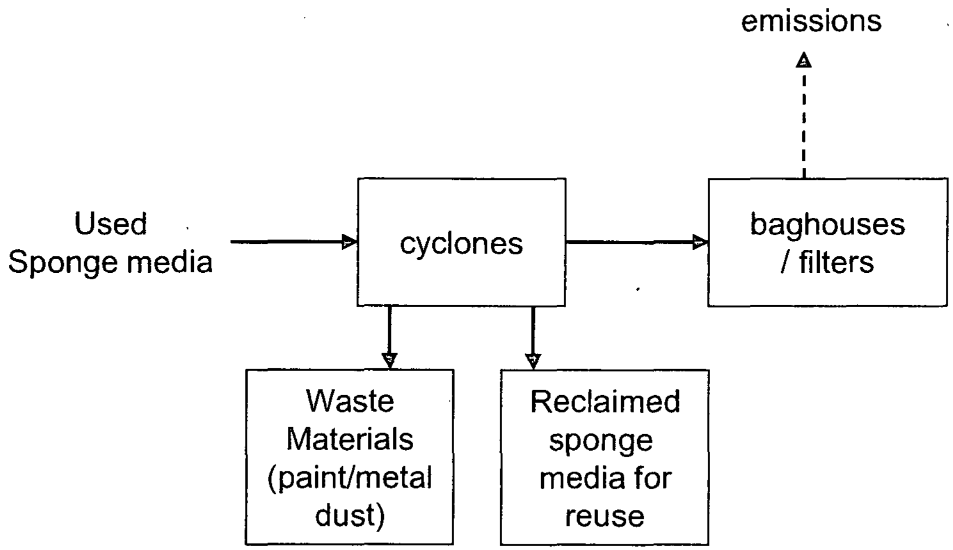
By ____

REGISTRATION NUMBER OF ASSOCIATED EQUIPMENT: ☐ ☐☐☐☐

PREMISES NUMBER: ☐☐ ☐☐☐☐

Emission Calculations Revised By ______________________________ Date ____________

Sponge-Jet Recycling Process



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 FUEL BURNING EQUIPMENT

Permit to Construct ☒ Registration Update ☐ Initial Registration ☐

1A. Owner of Equipment/Company Name
Calvert Cliffs 3 Nuclear Project, LLC ("CC3")
Unistar Nuclear Operating Services, LLC ("UNO")

Mailing Address/Street
750 East Pratt Street

City Baltimore State MD Zip Code 21202

Telephone Number 410-470-5857

Print Name/Title
Edward Jarmas, General Manager CC3

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 ☐☐ 1213 Application Date

1B. Equipment Location (if different from above give Street Number and Name, City, State, Zip and Telephone Number):
1650 Calvert Cliffs Pkwy, 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	0 4 1 1	0 8 1 5	
15	16-19	20-23	20-23

4. Describe this Equipment (Make, Model, Features, Manufacturer, etc.):
Two (2) identical diesel fire water pump engines; 440 bhp each.

5. Workmen's Compensation Coverage: Binder/Policy Number: TBD

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):

8. Major Activity, Product or Service of Company at this Location:
Electric Power Generation

9. Control Devices Associated with this Equipment

None ☐ 240 Simple/Multiple Cyclones ☐ 241 Spray/Adsorb Tower ☐ 242 Venturi Scrubber ☐ 243 Carbon Adsorber ☐ 244 Electrostatic Precipitator ☐ 245 Bag-house ☐ 246

Thermal/Catalytic Afterburner ☐ 247 Dry Scrubber ☐ 248 Other ☒ 249 Describe As required by NSPS

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

OIL-1000 GALLONS	SULFUR %	GRADE	NATURAL GAS-1000 FT^3	LP GAS-100 GALLONS	GRADE
11.5	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

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)
23	7.9	944.0	143
86-88	89-91	92-95	96-98

13. Total Stack Emissions (for this equipment only) in Pounds Per Operating Day (based on 4 hr/eng/day)

Particulate Matter	Oxides of Sulfur	Oxides of Nitrogen
1.2	0.04	23.3
99-104	105-110	111-116

Carbon Monoxide	Volatile Organic Compounds	PM-10
20.2	2.3	1.2
117-122	-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	1	4	4	4	4
165	166	167	168	169	170

15. What is the Maximum Rated Heat Input of this Unit (Million Btu/hr)? 3.2 (per engine)

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) [ ] 171-174 SCC Code [ ] 178-185

18. Annual Operating Rate [ ] 186-192 Maximum Design Hourly Rate [ ] 193-199

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

Regulation Code [ ] 215-218 Confidentiality [ ] 219

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

Appendix C

Determination of PM_{10} and $PM_{2.5}$ Emissions

This Appendix documents the basis of the estimated PM_{10} and $PM_{2.5}$ emissions from the CWS cooling tower, ESWS cooling towers, four emergency diesel generators (EDGs), two emergency station blackout diesel generators (SBOs), two emergency diesel fire water pumps (FWPs), and two sponge media blast units at CCNPP Unit 3.

C.1 Cooling Towers

The particulate emissions from the CWS and ESWS cooling towers are based, in part, on the method presented in AP-42 (EPA 1995)[7]. Other reference information used in the emission calculations includes procedures used to estimate evaporation of cooling tower drift droplets developed by Riesman and Frisbee and data on the cooling tower drift droplet size distribution provided by SPX Technologies.

According to AP-42, particulate emissions are a function of the flow rate of the re-circulating water, the total dissolved solids (TDS) concentration in the re-circulating water, and the drift loss of the cooling tower. Using the AP-42 method, particulate emissions from wet cooling towers may be calculated as follows:

$$PM = \rho \times W \times TDS \times DL \times 10^{-6}$$

where: PM is the hourly particulate emission rate (lb/hr)
ρ is the density of the re-circulating water (lb/gal);
W is the flow rate of the re-circulating water (gph);
TDS is the TDS concentration in the re-circulating water (ppm); and
DL is the drift loss of the re-circulating water (%).

The AP-42 method assumes that all of the drift (i.e., total dissolved solids emitted in the liquid water entrained in the air stream) is PM_{10}. However, for wet cooling towers with medium to high TDS levels, this method is overly conservative and predicts significantly higher PM_{10} emissions than would actually occur, even for towers equipped with high-efficiency drift eliminators (e.g., 0.0005% drift rate).

To develop a more realistic estimate of PM_{10} and $PM_{2.5}$ emissions, the drift particle size distribution is estimated using procedures developed by Joel Reisman and Gordon Frisbie (2004)[8]. Based on a representative drift droplet size distribution and TDS concentration in the re-circulating water, the amount of solid mass in each droplet size can be estimated by assuming that the mass of dissolved solids condenses to a spherical particle after all water evaporates and the density of the TDS is equivalent to a representative salt particle. Thus, using the drift droplet size distribution provided by SPX Technologies (see Figures C-1 and C-2), one can estimate the percentage of drift mass containing particles small enough to produce PM_{10} and $PM_{2.5}$, as further detailed in Appendix D.

For the CWS cooling tower, the design TDS concentration in the makeup water drawn from Chesapeake Bay will be 17,500 ppm. By limiting the cycles of concentration to 2, the maximum TDS concentration in the circulating water will be limited to approximately 35,000 ppm. 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. Based on this control efficiency, the maximum PM_{10} and $PM_{2.5}$ emissions from the CWS cooling tower will be approximately 260 and 42 tpy, respectively.

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[7] EPA 1995. Section 13.4, Wet Cooling Towers, *Compilation of Air Pollutant Emission Factors,* EPA Document No. AP-42

[8] "Calculating Realistic PM_{10} Emissions from Cooling Towers," Joel Reisman and Gordon Frisbie[8], *Environmental Progress*, April 2004

Figure C-1: Droplet Size Distribution for Drift Rate of 0.005%

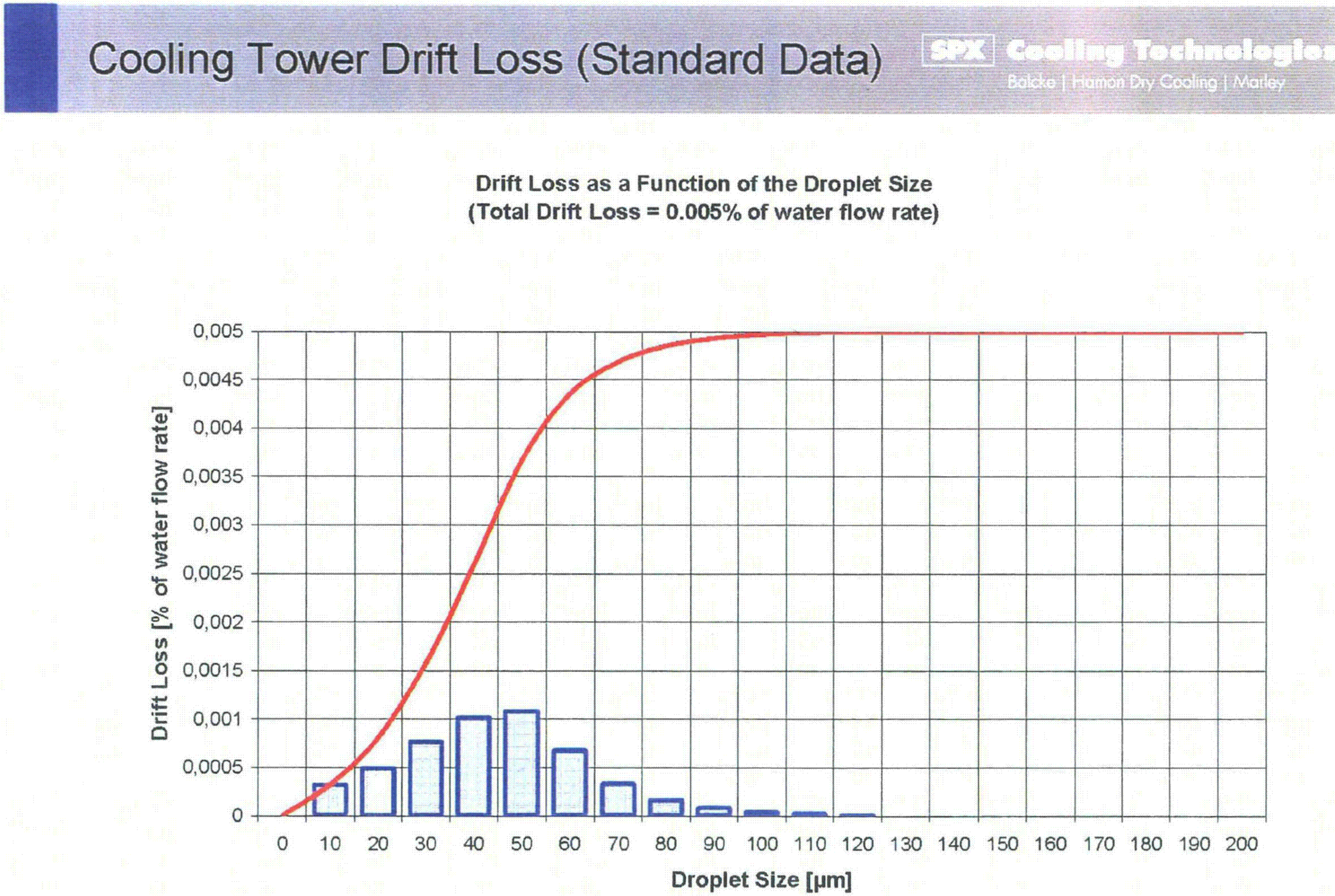
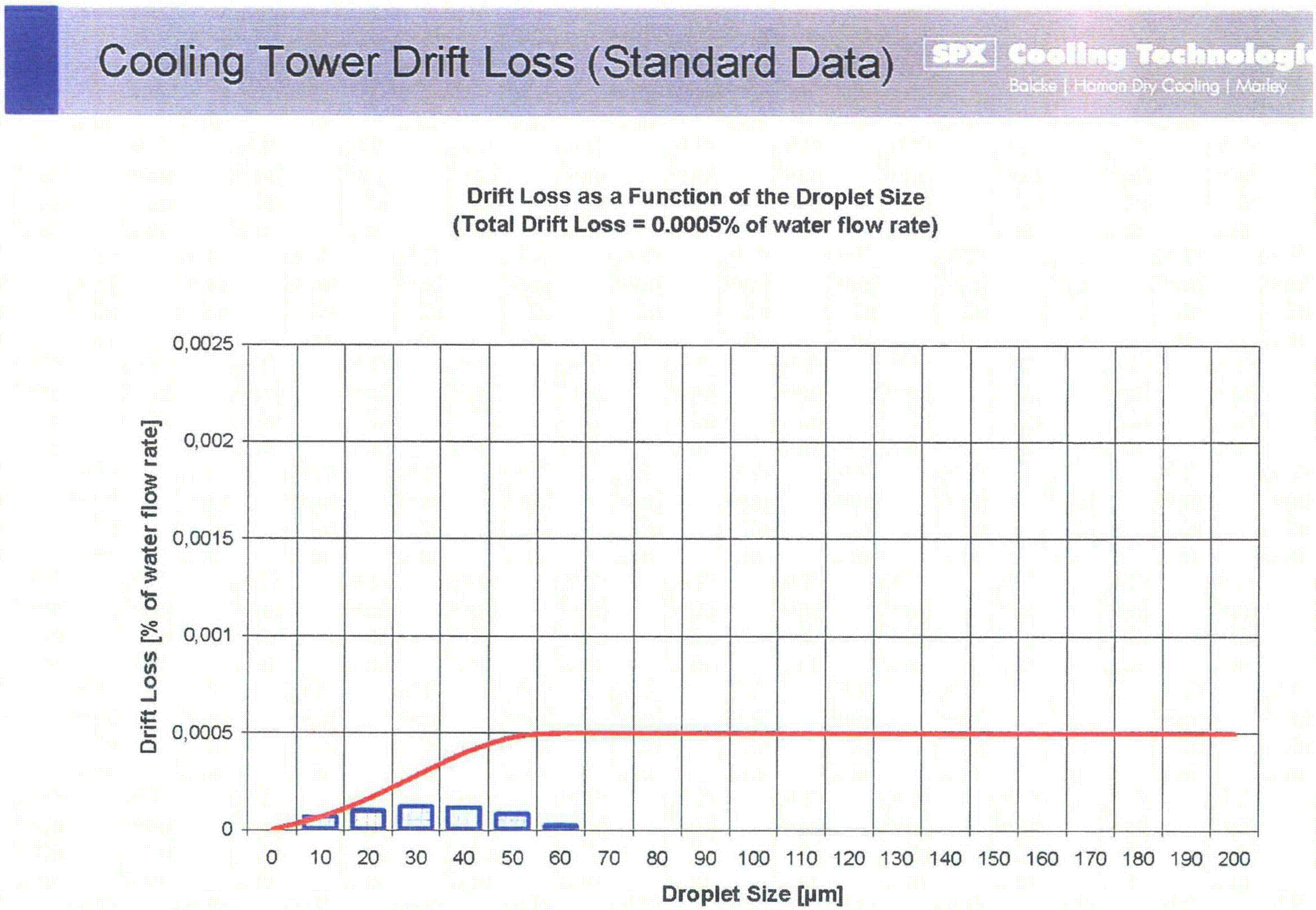


Figure C2: Droplet Size Distribution for Drift Rate of 0.0005%



For the ESWS cooling towers, the design TDS concentration in the makeup water from the desalination plant will be 372 ppm. By limiting the cycles of concentration to 10, the maximum TDS concentration in the circulating water will be 3,720 ppm. The mist eliminators will be designed to limit the drift discharged to the atmosphere to 0.005 percent of the circulating water flow. Based on this control efficiency, the maximum PM_{10} and $PM_{2.5}$ emissions from the ESWS cooling towers will be approximately 16 and 5 tpy, respectively (assuming only two ESWS cooling towers will operate at any time).

The maximum hourly and annual PM_{10} and $PM_{2.5}$ emissions from both the CWS and ESWS cooling towers are summarized in Table C-1. The particle size distribution for the CWS and ESWS cooling towers are presented in Tables C-2 and C-3, respectively

Table C-1: Maximum Hourly and Annual Emissions from Cooling Towers

Parameter	Units	CWS	ESWS (a)	Total(c)
No. of Units	N.A.	1	2	NA
Air Flow Rate	cfm	66,454,900 (b)	1,100,000	NA
Water Flow Rate	gpm	825,092 (b)	20,029	NA
Water Density	lb/gal	8.57 (c)	8.34	NA
Drift Rate	% CW	0.0005	0.005	NA
TDS (Make-up Water)	ppmw	17,500	372	NA
Cycles of Concentration	Ratio	2	10	NA
PM_{10}	Fraction	0.80 (d)	1.00	NA
$PM_{2.5}$	Fraction	0.13	0.32	NA
Hourly Emissions				
PM	lb/hr	74.25	3.73	77.97
PM_{10}	lb/hr	59.40	3.73	63.13
$PM_{2.5}$	lb/hr	9.65	1.19	10.85
Annual Emissions				
PM	tpy	325.20	16.33	341.53
PM_{10}	tpy	260.16	16.33	276.49
$PM_{2.5}$	tpy	42.28	5.23	47.50

(a) Only 2 ESWS cooling towers operate during any 24-hour period except for a planned shutdown case.
(b) The cooling tower air flow rates may be slightly higher than values reported above and the water flow rates may be slightly lower. However, the stated values were used in the modeling for conservatism.
(c) Totals may not reflect sum of individual emission rates due to rounding of values reported from spreadsheet
(d) PM_{10} fraction conservatively assumed to be 0.80 in estimating PM_{10} emissions from CWS cooling tower
(e)

Table C-2: Particle Size Distribution for CWS Cooling Tower

Salt Content	1.75000	wt. %
Cycles of Concentration	2	-
Salt Density	2.20	gm/cc

Droplet Diameter um	Droplet Volume cu. µm	Droplet Mass µg	Droplet Salt mass µg	Droplet Salt Volume cu μm^3	Intermediate calc	Salt Particle Diameter um	Particle Fraction (Estimated from SPX Figure)	Calculated Particle Size Distribution (Percent)	Particle Fraction Contributing to Particles < 10 um	Particle Fraction Contributing to Particles < 2.5 um	
10	524	5.2E-04	1.8E-05	8.3E+00	2.0E+00	2.52	0.000071	13.0	0.00007	0.00007	
20	4,189	4.2E-03	1.5E-04	6.7E+01	1.6E+01	5.03	0.000102	18.5	0.00010	0.12885	Total Fraction 2.5 um and below
30	14,137	1.4E-02	4.9E-04	2.2E+02	5.4E+01	7.55	0.000133	24.1	0.00013		
40	33,510	3.4E-02	1.2E-03	5.3E+02	1.3E+02	10.06	0.000122	22.2	0.00012		
50	65,450	6.5E-02	2.3E-03	1.0E+03	2.5E+02	12.58	0.000092	16.7	0.77245[b]	Total Fraction 10 um and below	
60	113,097	1.1E-01	4.0E-03	1.8E+03	4.3E+02	15.09	0.000031	5.6			
70	179,594	1.8E-01	6.3E-03	2.9E+03	6.8E+02	17.61	0.000000	0.0			
80	268,083	2.7E-01	9.4E-03	4.3E+03	1.0E+03	20.12	0.000000	0.0			
90	381,704	3.8E-01	1.3E-02	6.1E+03	1.4E+03	22.64	0.000000	0.0			
100	523,599	5.2E-01	1.8E-02	8.3E+03	2.0E+03	25.15	0.000000	0.0			
110	696,910	7.0E-01	2.4E-02	1.1E+04	2.6E+03	27.67	0.000000	0.0			
120	904,779	9.0E-01	3.2E-02	1.4E+04	3.4E+03	30.18	0.000000	0.0			
							0.000551	100.0			

(a) Methodology for calculating salt particle size from drift droplets taken from "Calculating Realistic PM_{10} Emissions from Cooling Towers", Reisman and Frisbie, *Environmental Progress*, April 2004. Drift droplet sizes estimated from SPX Drift Loss Curve for 0.0005% drift.

(b) PM_{10} fraction conservatively assumed to be 0.80 in estimating PM_{10} and $PM_{2.5}$ emissions from CWS cooling tower

Table C-3: Particle Size Distribution for ESWS Cooling Tower

Salt Content	0.03720	wt. %
Cycles of Concentration	10	-
Salt Density	2.20	gm/cc

Droplet Diameter um	Droplet Volume cu. µm	Droplet Mass µg	Droplet Salt mass µg	Droplet Salt Volume cu µm³	Intermediate calc	Salt Particle Diameter µm	Particle Fraction (Estimated from SPX Figure)	Calculated Particle Size Distribution (Percent)	Particle Fraction Contributing to Particles Below 10 µm	Particle Fraction Contributing to Particles Below 2.5 µm	
10	524	5.2E-04	1.9E-06	8.9E-01	2.1E-01	1.19	0.000071	13.0	0.00007	0.00007	
20	4,189	4.2E-03	1.6E-05	7.1E+00	1.7E+00	2.38	0.000102	18.5	0.00010	0.00010	
30	14,137	1.4E-02	5.3E-05	2.4E+01	5.7E+00	3.57	0.000133	24.1	0.00013	0.31481	Total
40	33,510	3.4E-02	1.2E-04	5.7E+01	1.4E+01	4.77	0.000122	22.2	0.00012		Fraction
50	65,450	6.5E-02	2.4E-04	1.1E+02	2.6E+01	5.96	0.000092	16.7	0.00009		2.5 um and
60	113,097	1.1E-01	4.2E-04	1.9E+02	4.6E+01	7.15	0.000031	5.6	0.00003		below
70	179,594	1.8E-01	6.7E-04	3.0E+02	7.2E+01	8.34	0.000000	0.0	0.00000		
80	268,083	2.7E-01	1.0E-03	4.5E+02	1.1E+02	9.53	0.000000	0.0	0.00000		
90	381,704	3.8E-01	1.4E-03	6.5E+02	1.5E+02	10.72	0.000000	0.0	1.00000	Total	
100	523,599	5.2E-01	1.9E-03	8.9E+02	2.1E+02	11.91	0.000000	0.0		Fraction	
110	696,910	7.0E-01	2.6E-03	1.2E+03	2.8E+02	13.10	0.000000	0.0		10 um and	
120	904,779	9.0E-01	3.4E-03	1.5E+03	3.7E+02	14.30	0.000000	0.0		below	
							0.000551	100.0			

(a) Methodology for calculating salt particle size from drift droplets taken from "Calculating Realistic PM_{10} Emissions from Cooling Towers", Reisman and Frisbie, *Environmental Progress*, April 2004. Drift droplet sizes estimated from SPX Drift Loss Curve for 0.005% drift.

C.2 Emergency Diesel Engines

Particulate matter emitted from diesel engines (such as the EDGs, SBOs, and FWPs) 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 vary with engine design and the control of the various components requires different control techniques given their chemical properties. 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 particulate emissions. These control techniques continue to evolve to comply with the ever more stringent particulate emission standards established in the NSPS for Compression Ignition Internal Combustion Engines promulgated by the EPA in July 2006 (40 CFR 60, Subpart IIII).

The particle size distribution and chemical composition of diesel exhaust emissions can vary depending on the engine type, the speed and load at which it is run, the fuel composition, the lubricating oil, and the emission control technology. The particle size distribution of diesel exhaust is bi-modal with a nuclei mode (0.0075 to 0.042 µm in diameter) and an accumulation mode (0.042 to 1.0 µm in diameter; Baumgard and Johnson 1996), most of which occur in aerodynamic diameters ranging from 0.1 to 0.25 µm in diameter[9]. The EPA has separately reported that $PM_{2.5}$ emissions represent approximately 97% of PM10 emissions in AP-42[10]. According to CARB, approximately 98% of the particles emitted from diesel engines are less than 10 microns in diameter, 94% less than 2.5 microns in diameter, and 92% less than 1.0 microns in diameter[11]. Based upon a consensus of agreement among these three references, AECOM concludes that diesel particulate matter is comprised almost entirely of $PM_{2.5}$. For this project, AECOM has utilized the AP-42 approach for determining the particle size fractions for the EDGs, SBOs, and FWPs, as shown in Tables C-4 and C-5.

At this time, the Co-Applicants have not yet selected the specific diesel engine models for emergency service 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, SBOs, and FWPs will be designed to comply with the current total 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 such as the EDGs, 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, such as the SBOs, particulate emissions must be limited to the standard for marine diesel engines of 0.50 g/kWh [40 CFR 60.4205(b)]. Particulate emissions from the FWPs must be limited to the standard for emergency fire pumps of 0.15 g/bhp [40 CFR 60.4205(c)].

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9 Baumgard, K. J. and J. H. Johnson 1996. "The Effect of Fuel and Engine Design on Diesel Exhaust Particle Size Distributions." *SAE Technical Paper Series*, #960131

10 EPA 1996. Section 3.4, Large Stationary Diesel And All Stationary Dual-fuel Engines, *Compilation of Air Pollutant Emission Factors,* EPA Document No. AP-42.

11 California Air Resources Board 1998. *Findings of the Scientific Review Panel on the Report on Diesel Exhaust*, as adopted at the Panel's April 22, 1998 Meeting.

Table C-4: Maximum Hourly and Annual Emissions from the EDGs and SBOs

Parameter	Units	EDG 1	EDG 2	EDG 3	EDG 4	SBO 1	SBO 2	4 EDGs	Total[(c)]
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.
Emission Factors									
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.
PM_{10}	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.
Hourly Emissions									
PM	lb/hr	3.35	3.35	3.35	3.35	5.51	5.51	13.40	24.42
PM_{10}	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
Annual Emissions									
PM	tpy	0.25	0.25	0.25	0.25	0.28	0.28	1.00	1.56
PM_{10}	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

(a) Based on compliance with 40 CFR 60.4205(d).
(b) Based on compliance with 40 CFR 60.4205(b).
(c) Totals may not reflect sum of individual emission rates due to rounding of values reported from spreadsheet

Table C-5: Maximum Hourly and Annual Emissions from the FWPs[a]

Parameter	Units	FWP 1	FWP 2	Total[(b)]
Engine Size	bhp	440	440	N.A.
Sulfur Content (a)	ppmw	15	15	N.A.
Hourly Firing Rate	gph	23	23	N.A.
Hours of Operation	hr/yr	500	500	N.A.
Emission Factors				
PM	g/bhp-hr	0.15 (a)	0.15 (a)	N.A.
PM_{10}	g/bhp-hr	0.15	0.15	N.A.
$PM_{2.5}$	g/bhp-hr	0.15	0.15	N.A.
Hourly Emissions				
PM	lb/hr	0.15	0.15	0.29
PM_{10}	lb/hr	0.15	0.15	0.29
$PM_{2.5}$	lb/hr	0.14	0.14	0.28
Annual Emissions				
PM	tpy	0.04	0.04	0.07
PM_{10}	tpy	0.04	0.04	0.07
$PM_{2.5}$	tpy	0.04	0.04	0.07

(a) Based on compliance with 40 CFR 4205(c).
(b) Totals may not reflect sum of individual emission rates due to rounding of values reported from spreadsheet

C.3 Sponge Media Blast Units

The proposed blast units use a composite of conventional abrasives and sponge-like polyurethane foam for surface preparation and cleaning of metal parts. The polyurethane sponge surrounds the point of abrasive impact, serving as a micro containment to capture airborne particulate emissions. Most of the particulate emissions from blasting operations will be sponge media that will be captured within the paint shop and recycled (not emitted to the atmosphere). Particulate emissions from the vacuum ejector serving each blast unit will be controlled by a baghouse and will be discharged to the atmosphere through a common 21-ft stack located along one side of the paint shop. The particulate emissions are based on the vacuum ejector flow rate and guaranteed outlet grain loading of 0.002 gr/acf. Because baghouse efficiency tends to increase with particle size, finer particle size distribution should be enhanced at the baghouse outlet. Because no data are available on outlet particle size distribution, the post-control particulate emissions are conservatively assumed to consist entirely of $PM_{2.5}$. The maximum hourly and annual PM_{10} and $PM_{2.5}$ emissions for each of the two sponge media blast units are presented in Table C-6.

Table C-6: Maximum Hourly and Annual Emissions from Each Sponge Media Blast Unit

Parameter	Units	Emission Input Data
Maximum operating rate	lb/hr	360 (a)
Maximum daily operating hours	hr/day	12
Maximum annual operating hours	hr/yr	1,248
Exhaust flow rate	Acfm	12,000
Exhaust temperature	°F	75
Emission Factors		
PM	gr/actual ft^3	0.002 (b) (c)
PM_{10}	gr/actual ft^3	0.002 (b) (c)
$PM_{2.5}$	gr/actual ft^3	0.002 (b) (c)
Hourly Emissions		
PM	lb/hr	0.206
PM_{10}	lb/hr	0.206
$PM_{2.5}$	lb/hr	0.206
Annual Emissions		
PM	tpy	0.128
PM_{10}	tpy	0.128
$PM_{2.5}$	tpy	0.128

(a) Maximum process input rate with no recycling.
(b) 100% of PM_{10} is conservatively assumed to be $PM_{2.5}$
(c) 0.002 gr/actual ft^3 based on BACT

Appendix D

Particulate Removal Efficiency for Cooling Tower Drift Eliminators

Table D-1: Relative Particulate Removal Efficiencyof Cooling Tower Drift Eliminators

Parameter	Units	CWS Cooling Tower (0.005% Efficiency)	CWS Cooling Tower (0.0005% Efficiency)
No. of Units	None	1	1
Air Flow Rate	cfm	66,454,900	66,454,900
Water Flow Rate	gpm	825,092	825,092
Water density	lb/gal	8.57	8.57
Drift Rate	% CW	0.005	0.0005
TDS (Make-up Water)	ppmw	17,500	17,500
No. of Cycles	Ratio	2	2
PM10	Fraction	0.52	0.80
PM2.5	Fraction	0.06	0.13
Houlry PM Emissions			
PM	lb/hr	742.46	74.25
PM10	lb/hr	386.08	59.40
PM2.5	lb/hr	44.55	9.65
Relative PM Removal Efficiency			
PM	%	N.A.	90.0%
PM10	%	N.A.	84.6%
PM2.5	%	N.A.	78.3%

Table D-2: Particle Size Distribution for Drift Rate of 0.005%

TDS Content	1.75000	wt. %
Cycles of Concentration	2	-
Salt Density	2.20	gm/cc

Droplet Diameter um	Droplet Volume cu. um	Droplet Mass ug	Droplet Salt mass ug	Droplet Salt Volume cu um3	Intermediate calc	Salt Particle Diameter um	Particle Fraction (Estimated from SPX Figure)	Calculated Particle Size Distribution (%)	Particle Fraction Contributing to Particles Below 10 um	Particle Fraction Contributing to Particles Below 2.5 um	
10	524	5.2E-04	1.8E-05	8.3E+00	2.0E+00	2.52	0.000333	6.44	0.00033	0.00033	
20	4,189	4.2E-03	1.5E-04	6.7E+01	1.6E+01	5.03	0.000500	9.66	0.00050	0.06403	Total
30	14,137	1.4E-02	4.9E-04	2.2E+02	5.4E+01	7.55	0.000833	16.10	0.00083		Fraction
40	33,510	3.4E-02	1.2E-03	5.3E+02	1.3E+02	10.06	0.001042	20.13	0.00104		2.5 um
50	65,450	6.5E-02	2.3E-03	1.0E+03	2.5E+02	12.58	0.001083	20.93	0.51853	Total	and below
60	113,097	1.1E-01	4.0E-03	1.8E+03	4.3E+02	15.09	0.000708	13.69		Fraction	
70	179,594	1.8E-01	6.3E-03	2.9E+03	6.8E+02	17.61	0.000333	6.44		10 um and	
80	268,083	2.7E-01	9.4E-03	4.3E+03	1.0E+03	20.12	0.000167	3.22		below	
90	381,704	3.8E-01	1.3E-02	6.1E+03	1.4E+03	22.64	0.000083	1.61			
100	523,599	5.2E-01	1.8E-02	8.3E+03	2.0E+03	25.15	0.000042	0.81			
110	696,910	7.0E-01	2.4E-02	1.1E+04	2.6E+03	27.67	0.000021	0.40			
120	904,779	9.0E-01	3.2E-02	1.4E+04	3.4E+03	30.18	0.000029	0.56			
							0.005175	100.00			

(a) Methodology for calculating salt particle size from drift droplets taken from "Calculating Realistic PM10 Emissions from Cooling Towers", Reisman and Frisbie, *Environmental Progress*, April 2004. Drift droplet sizes estimated from SPX Drift Loss Curve for 0.005% drift.

Table D-3: Particle Size Distribution for Drift Rate of 0.0005% Efficiency

Salt Content	1.75000	wt. %
Cycles of Concentration	2	-
Salt Density	2.20	gm/cc

Droplet Diameter um	Droplet Volume cu. um	Droplet Mass ug	Droplet Salt mass ug	Droplet Salt Volume cu um3	Intermediate calc	Salt Particle Diameter um	Particle Fraction (Estimated from SPX Figure)	Calculated Particle Size Distribution (Percent)	Particle Fraction Contributing to Particles Below 10 um	Particle Fraction Contributing to Particles Below 2.5 um	
10	524	5.2E-04	1.8E-05	8.3E+00	2.0E+00	2.52	0.000071	13.0	0.00007	0.00007	
20	4,189	4.2E-03	1.5E-04	6.7E+01	1.6E+01	5.03	0.000102	18.5	0.00010	0.12885	Total
30	14,137	1.4E-02	4.9E-04	2.2E+02	5.4E+01	7.55	0.000133	24.1	0.00013		Fraction
40	33,510	3.4E-02	1.2E-03	5.3E+02	1.3E+02	10.06	0.000122	22.2	0.00012		2.5 um and
50	65,450	6.5E-02	2.3E-03	1.0E+03	2.5E+02	12.58	0.000092	16.7	0.77245[b]	Total	below
60	113,097	1.1E-01	4.0E-03	1.8E+03	4.3E+02	15.09	0.000031	5.6		Fraction	
70	179,594	1.8E-01	6.3E-03	2.9E+03	6.8E+02	17.61	0.000000	0.0		10 um and	
80	268,083	2.7E-01	9.4E-03	4.3E+03	1.0E+03	20.12	0.000000	0.0		below	
90	381,704	3.8E-01	1.3E-02	6.1E+03	1.4E+03	22.64	0.000000	0.0			
100	523,599	5.2E-01	1.8E-02	8.3E+03	2.0E+03	25.15	0.000000	0.0			
110	696,910	7.0E-01	2.4E-02	1.1E+04	2.6E+03	27.67	0.000000	0.0			
120	904,779	9.0E-01	3.2E-02	1.4E+04	3.4E+03	30.18	0.000000	0.0			
							0.000551	100.0			

(a) Methodology for calculating salt particle size from drift droplets taken from "Calculating Realistic PM10 Emissions from Cooling Towers", Reisman and Frisbie, *Environmental Progress*, April 2004. Drift droplet sizes estimated from SPX Drift Loss Curve for 0.0005% drift.

(b) PM10 fraction conservatively assumed to be 0.80 in estimating PM10 emissions from the CWS cooling tower with 0.0005% drift loss.

Appendix E

Background Sources for Multi-Source Cumulative Modeling

Table E-1: PM_{10} Background Sources

StateFIPs+Facility ID	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-	26	376552.45	4250099.84	30.0	2.94E-01	8.2	314.8	30.5	1.2
24009-009-0021-	38	376552.45	4250099.84	30.0	5.87E-02	13.1	422.0	14.3	2.4
24009-009-0021-	36	376552.45	4250099.84	30.0	7.13E-02	13.1	422.0	14.3	2.4
24017-017-0014-	8	327340.77	4247375.90	0.0	2.20E-01	14.6	727.6	24.4	6.8
24017-017-0014-	7	327340.77	4247375.90	0.0	2.31E-01	14.6	727.6	24.4	6.8
24017-017-0014-	12	327340.77	4247375.90	0.0	6.14E-01	14.6	727.6	24.4	6.8
24017-017-0014-	10	327340.77	4247375.90	0.0	6.19E-01	14.6	727.6	24.4	6.8
24017-017-0014-	9	327340.77	4247375.90	0.0	6.88E-01	14.6	727.6	24.4	6.8
24017-017-0014-	11	327340.77	4247375.90	0.0	7.30E-01	14.6	727.6	24.4	6.8
24017-017-0014-	6	327340.77	4247375.90	0.0	3.67E-02	56.7	408.2	20.4	1.5
24017-017-0014-	5	327340.77	4247375.90	0.0	4.20E-02	56.7	408.2	20.4	1.5
24017-017-0014-	15	327340.77	4247375.90	0.0	3.55E+01	213.4	405.4	30.5	5.9
24017-017-0014-	14	327340.77	4247375.90	0.0	4.81E+01	213.4	405.4	30.5	5.9
24019-019-0029-	22	418400.00	4267700.00	6.0	3.67E-03	7.0	505.4	12.2	0.5
24019-019-0029-	21	418400.00	4267700.00	6.0	1.73E-02	7.0	505.4	12.2	0.5
24019-019-0029-	19	418400.00	4267700.00	6.0	2.68E-02	7.3	519.3	3.0	1.4
24019-019-0029-	35	418400.00	4267700.00	6.0	8.50E-02	9.1	422.0	9.1	0.6
24019-019-0029-	34	418400.00	4267700.00	6.0	4.25E-01	9.1	422.0	9.1	0.6
24033-033-0014-	6	353061.16	4267369.58	0.0	3.11E-01	9.1	755.4	27.4	3.1
24033-033-0014-	9	353061.16	4267369.58	0.0	2.62E-01	12.2	755.4	17.4	4.6
24033-033-0014-	14	353061.16	4267369.58	0.0	1.35E-01	64.9	813.2	32.3	5.6
24033-033-0014-	15	353061.16	4267369.58	0.0	1.35E-01	64.9	813.2	32.3	5.6
24033-033-0014-	16	353061.16	4267369.58	0.0	2.04E-01	64.9	814.8	34.4	5.6
24033-033-0014-	17	353061.16	4267369.58	0.0	2.18E-01	64.9	814.8	34.4	5.6
24033-033-0014-	13	353061.16	4267369.58	0.0	7.95E-03	67.1	588.7	9.4	2.1
24033-033-0014-	8	353061.16	4267369.58	0.0	6.47E+00	213.4	644.3	9.1	5.1
24033-033-0014-	1	353061.16	4267369.58	0.0	2.11E+00	216.1	415.9	17.1	9.6
24033-033-0014-	2	353061.16	4267369.58	0.0	2.19E+00	216.1	415.9	17.1	9.6
24033-033-0014-	7	353061.16	4267369.58	0.0	1.22E+01	217.0	395.9	19.2	7.6
24037-037-0017-	48	373200.00	4237600.00	17.7	5.25E-03	1.2	294.3	15.2	1.0
24037-037-0017-	153	373200.00	4237600.00	17.7	2.10E-02	3.7	294.3	19.5	0.3
24037-037-0017-	205	373200.00	4237600.00	17.7	1.05E-02	4.6	505.4	19.5	0.3
24037-037-0017-	194	373200.00	4237600.00	17.7	5.25E-03	6.1	477.6	15.2	0.3
24037-037-0017-	196	373200.00	4237600.00	17.7	5.25E-03	6.1	477.6	15.2	0.3
24037-037-0017-	195	373200.00	4237600.00	17.7	3.67E-02	6.1	477.6	15.2	0.3
24037-037-0017-	88	373200.00	4237600.00	17.7	5.25E-03	11.0	463.7	11.0	0.5
24037-037-0017-	89	373200.00	4237600.00	17.7	5.25E-03	11.0	463.7	11.0	0.5
24037-037-0017-	198	373200.00	4237600.00	17.7	1.21E-01	11.0	519.3	15.5	0.6
24037-037-0017-	199	373200.00	4237600.00	17.7	1.57E-02	21.3	533.2	4.3	1.5
24041-041-0069-	11	407100.00	4294200.00	9.0	8.92E-02	12.2	765.4	30.5	0.4
24041-041-0069-	12	407100.00	4294200.00	9.0	8.92E-02	12.2	765.4	30.5	0.4
24041-041-0069-	9	407100.00	4294200.00	9.0	6.30E-02	21.3	705.4	30.5	0.9
24041-041-0069-	8	407100.00	4294200.00	9.0	3.83E-01	21.3	634.3	24.4	1.0
24041-041-0069-	7	407100.00	4294200.00	9.0	4.04E-01	21.3	634.3	30.5	1.0
24041-041-0069-	10	407100.00	4294200.00	9.0	1.10E+00	21.3	705.4	30.5	0.9

Table E-2: SO_2 Background Sources

StateFIPs+Facility ID	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-	26	376552.45	4250099.84	30.0	1.05E-02	8.2	314.8	30.5	1.2
24009-009-0021-	38	376552.45	4250099.84	30.0	3.06E-02	13.1	422.0	14.3	2.4
24009-009-0021-	36	376552.45	4250099.84	30.0	3.67E-02	13.1	422.0	14.3	2.4
24017-017-0014-	8	327340.77	4247375.90	0.0	3.99E-01	14.6	727.6	24.4	6.8
24017-017-0014-	7	327340.77	4247375.90	0.0	4.36E-01	14.6	727.6	24.4	6.8
24017-017-0014-	12	327340.77	4247375.90	0.0	1.17E+00	14.6	727.6	24.4	6.8
24017-017-0014-	10	327340.77	4247375.90	0.0	1.17E+00	14.6	727.6	24.4	6.8
24017-017-0014-	9	327340.77	4247375.90	0.0	1.37E+00	14.6	727.6	24.4	6.8
24017-017-0014-	11	327340.77	4247375.90	0.0	1.38E+00	14.6	727.6	24.4	6.8
24017-017-0014-	6	327340.77	4247375.90	0.0	1.84E-01	56.7	408.2	20.4	1.5
24017-017-0014-	5	327340.77	4247375.90	0.0	4.41E-01	56.7	408.2	20.4	1.5
24017-017-0014-	15	327340.77	4247375.90	0.0	1.07E+03	213.4	405.4	30.5	5.9
24017-017-0014-	14	327340.77	4247375.90	0.0	1.13E+03	213.4	405.4	30.5	5.9
24033-033-0014-	6	353061.16	4267369.58	0.0	5.44E-01	9.1	755.4	27.4	3.1
24033-033-0014-	9	353061.16	4267369.58	0.0	4.81E-01	12.2	755.4	17.4	4.6
24033-033-0014-	16	353061.16	4267369.58	0.0	3.13E-02	64.9	814.8	34.4	5.6
24033-033-0014-	17	353061.16	4267369.58	0.0	6.83E-01	64.9	814.8	34.4	5.6
24033-033-0014-	15	353061.16	4267369.58	0.0	7.80E-01	64.9	813.2	32.3	5.6
24033-033-0014-	14	353061.16	4267369.58	0.0	8.00E-01	64.9	813.2	32.3	5.6
24033-033-0014-	12	353061.16	4267369.58	0.0	1.13E-02	67.1	588.7	9.4	2.1
24033-033-0014-	11	353061.16	4267369.58	0.0	1.50E-02	67.1	588.7	9.4	2.1
24033-033-0014-	13	353061.16	4267369.58	0.0	3.18E-02	67.1	588.7	9.4	2.1
24033-033-0014-	8	353061.16	4267369.58	0.0	1.31E+02	213.4	644.3	9.1	5.1
24033-033-0014-	1	353061.16	4267369.58	0.0	7.10E+02	216.1	415.9	17.1	9.6
24033-033-0014-	2	353061.16	4267369.58	0.0	7.41E+02	216.1	415.9	17.1	9.6
24033-033-0014-	7	353061.16	4267369.58	0.0	1.48E+02	217.0	395.9	19.2	7.6
24033-033-2200-	1	337600.00	4281400.00	61.0	7.03E-01	50.3	377.0	19.2	4.6
24033-033-2200-	2	337600.00	4281400.00	61.0	7.09E-01	50.3	377.0	19.2	4.6
24037-037-0001-	18	365900.00	4222800.00	0.0	3.67E-01	4.9	533.2	6.7	0.8
24037-037-0001-	19	365900.00	4222800.00	0.0	3.81E-01	4.9	533.2	6.7	0.8
24037-037-0001-	15	365900.00	4222800.00	0.0	1.71E+00	9.1	672.0	3.0	0.8
24037-037-0001-	16	365900.00	4222800.00	0.0	2.32E+00	9.1	672.0	3.0	0.8
24037-037-0001-	17	365900.00	4222800.00	0.0	2.49E+00	9.1	699.8	9.4	0.8
24037-037-0001-	13	365900.00	4222800.00	0.0	1.32E+00	12.2	574.8	3.0	0.8
24037-037-0001-	14	365900.00	4222800.00	0.0	1.72E+00	12.2	574.8	3.0	0.8
24041-041-0069-	11	407100.00	4294200.00	9.0	1.57E-02	12.2	765.4	30.5	0.4
24041-041-0069-	12	407100.00	4294200.00	9.0	1.57E-02	12.2	765.4	30.5	0.4
24041-041-0069-	9	407100.00	4294200.00	9.0	7.45E-01	21.3	705.4	30.5	0.9
24041-041-0069-	8	407100.00	4294200.00	9.0	8.66E-01	21.3	634.3	24.4	1.0
24041-041-0069-	10	407100.00	4294200.00	9.0	8.98E-01	21.3	705.4	30.5	0.9
24041-041-0069-	7	407100.00	4294200.00	9.0	9.03E-01	21.3	634.3	30.5	1.0
Naval Surface Warfare Ctr-Dahlgren	1	322390.00	4243590.00	9.1	1.34E+00	5.0	607.2	41.1	0.6
Naval Surface Warfare Ctr-Dahlgren	4	322390.00	4243590.00	9.1	8.63E-06	10.7	449.8	24.7	0.9
Naval Surface Warfare Ctr-Dahlgren	5	322390.00	4243590.00	0.0	1.89E+00	10.7	449.8	24.7	0.9
Naval Surface Warfare Ctr-Dahlgren	9	322390.00	4243590.00	9.1	3.32E+01	2.2	505.4	17.0	0.1
Naval Surface Warfare Ctr-Dahlgren	10	322390.00	4243590.00	9.1	4.36E-01	3.7	788.7	62.1	0.4
Naval Surface Warfare Ctr-Dahlgren	11	322390.00	4243590.00	0.0	4.59E-01	9.1	422.0	24.4	0.4

Figure E-1: Location of PM_{10} Background Sources

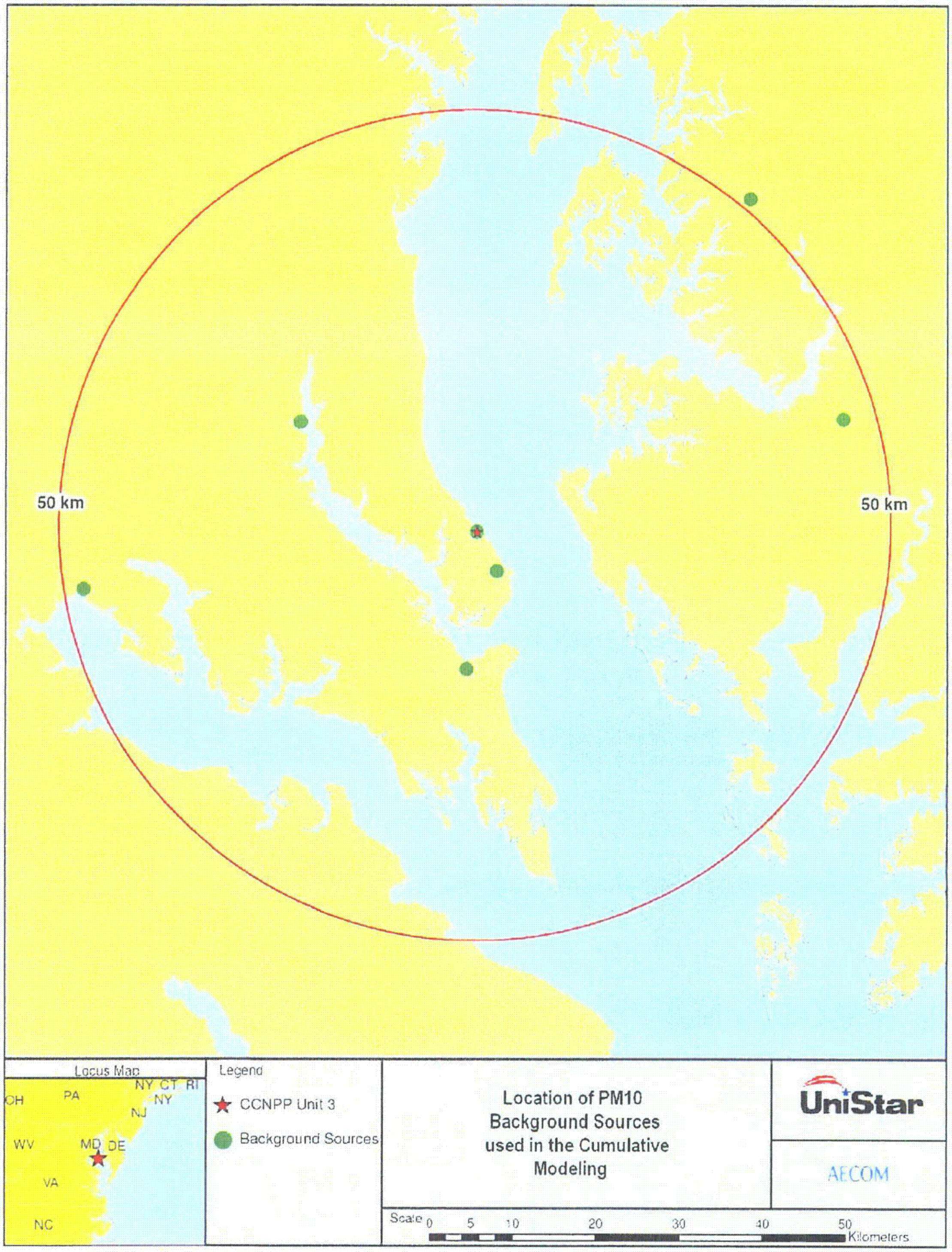

Figure E-2: Location of SO_2 Background Sources

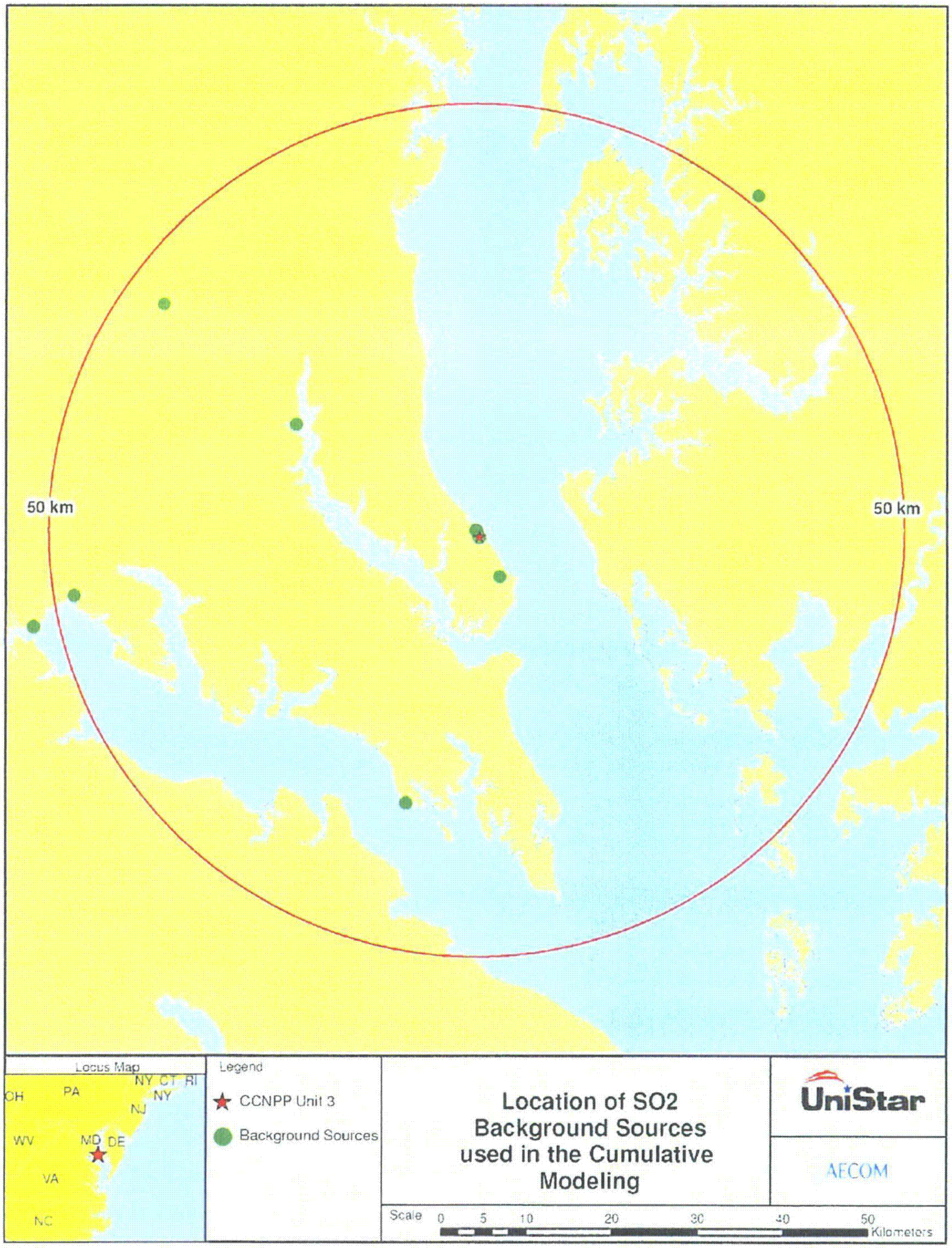

Table E-3: PM_{10} CCNPP Units 1-2 Emissions

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 E-4: 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										
SO_2	g/sec	2.07E+00	2.29E-01	2.29E-01	2.29E-01	1.65E-01	8.27E-02	8.27E-02	1.27E-01	none
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	374,119	374,085	374,090	374,130	373,983	373,997	373,997	374,286	374,305
UTM-Y (Zone 18)	m	4,254,822	4,254,779	4,254,774	4,254,734	4,254,841	4,254,823	4,254,823	4,254,706	4,254,569
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.